PROCEEDINGS OF THE

AMERICAN PHILOSOPHICAL SOCIETY.

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. X. 1866. No. 75.

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C. C. Short

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY.

VOL. X. JANUARY, 1866. No. 75.

Stated Meeting, January 5, 1866.

Present, twelve members.

Vice-President CRESSON, in the Chair.

Letters acknowledging the receipt of publications were received from the Imperial Institute of France, Paris, November 6th, 1865; Royal Society, London, October 12th, 1865; Geological Society of London, November 8th, 1865; Radcliff Observatory, Oxford, September 1st; Natural H. S., Newcastle on T., September 21st, 1865; Dr. John W. Dawson, Montreal, December 14th, 1865; American Antiquarian Society, December 22d, 1865; Corporation of Harvard College, December 29th, 1865; New York Historical Society, December 28th, 1865; New Jersey Historical Society, Newark, December 21st, 1865; Pennsylvania Historical Society, December 28th, 1865; Library of Congress, Washington, December 29th, 1865.

Donations for the Library were received from the Royal, Royal Astronomical, Royal Geographical, and Geological Societies in London; the Dublin Quarterly Journal of Science; the New Hampshire Adjutant-General and Quartermaster-General; James B. Francis, of New York; the Franklin Institute, Academy of Natural Sciences, and Pennsylvania Historical Society, of Philadelphia; and the United States Naval Observatory and Congressional Library.

Mr. Fraley announced the death of Col. C. D. Graham, U. S. A., at Boston.

Mr. Chase, after explaining the mechanical laws which appear to produce the differences between the European magnetic curves and the daily barometric curves delineated in Leverrier's "Bulletin International," presented a statement of his observations on skylight polarization at Philadelphia.

Recent observations with a Savart polariscope having led me to results which, while generally confirmatory, differ, in a few particulars, from those published by Sir David Brewster (Philosophical Mag. [4] 30, 118 and 166 Sqq.), I place some of them on record to facilitate a comparison with similar observations at other places.

1. In all the great circles which pass through the sun, the polarization of a clear sky is positive, except in the neighborhood of the solar and anti-solar points. If the polariscope is rotated from the positive maximum, the bands gradually diminish in brilliancy, vanishing at about 45°, and attaining a negative maximum at about 90°.

2. Within the primary lemniscates, of which the solar and anti-solar points are the respective centres, and the neutral points (actual or theoretical*) are the limits, the polarization of a clear sky is negative when the bands pass towards the sun's centre, vanishing when the bands are inclined 45° to the solar radii, and attaining a positive maximum when the inclination reaches 90°.

3. Arago's and Babinet's neutral points can be seen as well before sunrise as after sunset provided the atmospheric conditions are the same. Brewster gives the preference to the evening observation, but apparently for no other reason than that the sky is then generally clearer than in the morning. (Vol. cit. p. 118.)

4. I have repeatedly, and with little comparative difficulty, observed Brewster's neutral point. In the majority of cases, when the sun's altitude has been sufficient, I have been able to fix its position with nearly as much facility as that of Babinet's. (For the difficulties of Brewster and Babinet, see loc. cit. pp. 119, 166, 181.)

5. Within the solar primary lemniscate, it is frequently difficult to make any ordinary observation of the polarized bands, on account of the dazzling intensity of the light. But when the direct rays of the sun have been shut off by a thin disk (placed with its edge towards the eye, so that the polarization will not be affected by reflection from the surface of the disk), I have often been able to mark the

* There is one *theoretical* neutral point below the anti-solar point. It is probably never above the horizon when there is light enough to determine its position.

opposite polarizations and the position of the neutral points with perfect ease, even at midday.

6. In our climate it is by no means unusual to have days on which all the three neutral points can be observed, and their places determined. During the whole period of Brewster's observations at St. Andrew's he found but two such days, April 5th and 8th, 1842 (loc. cit. pp. 124, 163).

7. Quasi neutral lines, dividing bands of opposite polarization, can be found in nearly all parts of the sky by rotating the polariscope 45° from the line of maximum positive or negative polarization. But a slight additional rotation will show that the neutralization is only apparent.

8. The position of a true neutral point can be determined by sweeping its neighborhood alternately with the vertical and with the horizontal bands and marking the intersection of the lines of vanishing polarization.

9. In consequence of the arrangement of the lines of equal polarization, when the sky is swept with a polariscope for a few degrees on each side of a neutral point, the line which separates the oppositely polarized bands forms curves with a convexity determined by the position of the sun or the anti-solar point.*

10. Some of my observations have indicated an apparent correlation between these curves and the magnetic dip and terrestrial latitude. I have not been able to satisfy myself whether this correspondence was merely accidental, or whether it indicated another point of analogy between the laws of light and magnetism.

11. The varying effects of haze or cloud, appear, on the whole, to confirm Brewster's theory that the neutral point is produced "by the opposite action of light polarized by reflection and refraction." (See pp. 123, 169, 176, 178, 180.)

12. In one instance, soon after sunset, the reflection from scattered clouds in the neighborhood of the anti-solar point was such as to totally eclipse Arago's neutral point, the polarization being positive over the entire arch, from Babinet's neutral point to the eastern horizon.

The report of the Judges of the annual election held this day was read, and the following named officers were declared

* I am not sure whether this is the "singular effect" thus described by Brewster (loc. cit. p. 124). "In conveying the bands vertically round, the neutral line, in place of crossing them at a right angle, was the arc of a circle, to which one of the bands was a tangent." (See also pp. 121, 167.)

duly elected according to the laws, ordinances, and regulations of the Society for the ensuing year:

President.

George B. Wood.

Vice-Presidents.

John C. Cresson,
Isaac Lea,
George Sharswood.

Secretaries.

Charles B. Trego,
E. Otis Kendall,
John L. Le Conte,
J. Peter Lesley.

Members of the Council for Three Years.

Frederick Fraley,
Robert Patterson,
Daniel R. Goodwin,
Eli K. Price.

Curators.

Franklin Peale,
Elias Durand,
Joseph Carson.

Treasurer.

Charles B. Trego.

Prof. Lesley was nominated for Librarian.

Pending nominations Nos. 540 to 546 were read.

And the Society was adjourned.

Stated Meeting, January 19, 1866.

Present, fifteen members.

Dr. Wood, President, in the Chair.

Letters acknowledging the receipt of publications were received from the following Societies:

Royal Society at Upsal, October 1st, 1865; K. K. Geogr. Reichs., Wein, September 22d, 1865; K. K. Geol. Gesell. Wein, October 10th, 1865; Royal Lombardy Institute, Milan, December 1st, 1862, August 27th, 1863; Linnean Society, London, July 26th, 1865; Society of Antiquaries, London, December 22d, 1865; American Antiquarian Society, Boston, January 11th, 1866; Corp. Yale College, New Haven, January 13th, 1866; Lyceum Natural History, New Jersey, January 10th, 1866; New Jersey Historical Society, Newark, January 5th, 1866; Academy of Sciences, St. Louis, December 23d, 1865.

Donations for the Library were announced from the London Linnean Society; the Trinity College Observatory, Dublin; Dr. Lloyd; the Boston Public Library; Silliman's Journal; Blanchard & Lea; the Franklin Institute; and Mr. Matthew Ryan, of Washington.

Mr. Cresson gave an account of a recent useful application of the principle of dia-magnetism first noticed by Faraday in 1845 at the close of his extended series of Experimental Researches in Electricity, but remaining unapplied and almost unnoticed for nearly twenty years.

According to Faraday's report to the Royal Society the force termed dia-magnetic gives rise to a repellant action between a magnet and various bodies previously supposed destitute of magnetic relations. This property was found in vegetable, animal, and earthy substances.

One of the phenomena exhibited in his experiments on these bodies is a discrimination in the attraction or repulsion exerted by a magnet, between substances placed near it in liquid suspension so as to be capable of free motion. The discriminating action is governed by the relative degree of repellant or attractive power belonging to the different bodies.

A result of this discrimination is to cause the particles most feebly repelled or most strongly attracted to come between the magnet and such other particles as are more strongly repelled or more feebly attracted; thus making the particles most feebly affected either by attraction or repulsion behave as if they belonged to the opposite magnetic class.

The practical use now made of this principle consists in imparting

inductive magnetism to the iron shell of a steam boiler by suspending within it a number of hardened steel permanent magnets. This has been found to effect the removal of sedimentary scale formed from the earthy salts held by the water, and to prevent the farther deposit of crystalline scale, so that boilers using water highly charged with calcareous matters are cleansed from adhering scale in a few weeks and kept clean.

Attention was called to the extraordinary high state of the barometer during the intensely cold weather of the 7th and 8th insts., viz., 31¼ to 31½ inches.

Prof. Lesley was elected Librarian for the ensuing year.

The Standing Committees were then appointed as follows:

Finance.—Mr. Fraley, Mr. J. F. James, Mr. Marsh.

Publication.—T. P. James, Mr. Trego, Mr. Carson, Mr. Price, Mr. Fraley.

Hall.—Mr. Peale, Mr. P. E. Chase, Mr. S. W. Roberts.

Library.—Dr. Bell, Dr. Coates, Mr. Price, Mr. Barnes, Mr. Briggs.

The list of surviving members was read. The number of members on the 1st January was 408, of whom 259 were resident in the United States, and 149 in foreign countries.

The Society proceeded to ballot for candidates for membership. Nomination No. 541 was postponed on account of the absence of members signing the recommendation. Pending nomination No. 547 and new nomination No. 548 were read.

Mr. Fraley offered the following resolution: That the Treasurer be and he is hereby authorized to have five hundred copies of the Laws of the Society printed in pamphlet form for the use of the members, and that on the election of any person as a resident member of the Society, a copy of the laws shall be sent to him with the notice of his election.

The ballot-boxes were opened and the following named gentlemen declared to be duly elected members:

Mr. Thomas S. Blair, of Pittsburg, Pa.

Prof. E. D. Cope, of Haverford College, Pa.

Prof. Horatio C. Wood, University of Penna.

Mr. George Davidson, of the U. S. Coast Survey.

Hon. Charles Hale, U. S. Consul at Alexandria.
Hon. William Strong, Supreme Court of Penna.
And the Society was adjourned.

Stated Meeting, February 2, 1866.

Present, fifteen members.

Dr. Wood, President, in the Chair.

Letters accepting membership were received from Mr. George Davidson, dated Germantown, January 25th; from the Hon. William Strong, dated Philadelphia, January 31st; and from Prof. Edward D. Cope, dated Haverford College, January 31st, 1866.

Letters acknowledging publications were received from the Boston Society of Natural History, January 24th and May 1st, 1864; Boston Public Library, January 4th and January 22d, 1866.

Donations were received for the Library from the Royal Astronomical, and British Meteorological Societies, Trübner & Co., and Stevens & Bros., booksellers, London; Prof. Zantedeschi, of Padua; and the Boston S. N. History.

Dr. Coates announced the death of a member, Mr. George Ord, at his residence in Philadelphia, on the 24th inst., aged 85. Mr. Isaac Lea was appointed to prepare an obituary notice of the deceased.

Mr. Fraley announced the death of a member, Judge Oswald Thompson, at Germantown, on the 22d inst., aged 57. Mr. E. K. Price was appointed to prepare an obituary notice of the deceased.

Mr. Dubois exhibited to the Society some specimens of photography, which are chiefly remarkable as being the work of a Siamese artist, *Pra Wisut Yotamad*, a nobleman of high rank, and master of the Royal Mint at Bangkok. He understands no language but that of Siam, and learned the art at home. He has, however, an unusual aptitude for the higher class of mechanical arts, and for experiments in natural philosophy.

The Queen of England having sent a present to the King of Siam, of a photographic apparatus, it was confided to this minister of State, and by the help of a Prussian artist who was on his way to Japan, and also of an English treatise which was read to him by an American missionary, he became acquainted with the principles and practice, and taught them to his son. These pictures are some of his productions. One of them is a portrait of himself, in a costume fitted to a warm climate. They were brought as a present from him, to several of the officers of the United States Mint, in care of Dr. House, returning to this country on a visit.

It is most interesting to observe the march of this admirable art, not waiting for the previous civilization which might seem requisite to give a taste for it, or at least a capacity for using it. But a little reflection will show that its products are exactly fitted to wake up the torpid mind, and to convince even the barbarian, of the intrinsic value of the arts and sciences, and of the social status which produces them.

Mr. P. E. Chase communicated an account of a gas explosion at Haverford College. Prof. Cresson made some remarks to elucidate the explosions which take place from defective gas pipes.

Pending nominations Nos. 541, 547 and 548, were read.

And the Society was adjourned.

Stated Meeting, February 16, 1866.

Present, thirteen members.

Dr. Wood, President, in the Chair.

A letter of acceptance was read from Dr. H. C. Wood, dated Philadelphia, February 5th, 1866.

A letter was read announcing the decease of a member, E. J. Bring, of Lund, dated Stockholm, 27th 11th month, 1865.

A letter desiring exchanges was received from C. H. Hart, Corresponding Secretary of the Numismatic and Antiquarian Society of Philadelphia, which Society was, on motion,

ordered to be put upon the list of correspondents to receive the Proceedings.

A letter from Dr. Leidy was read respecting Captain Stellwagen's donation of the fragment of an ancient cover of a sarcophagus found at Carthage.

Letters of envoi were received from J. D. Whitney, Chief Geologist of California; the Cent. Obs., St. Petersburg, August 28th, 1865; the Vienna Academy, September 23d, and the Stockholm Academy, November 17th.

Letters of acknowledgment were received from the Cen. Obs., St. Petersburg, September 1st, and the Amsterdam Academy, October 18th, 1865.

Donations for the Library were announced from the Academies at St. Petersburg, Stockholm, Vienna, Munich, and Brussels; the Societies at Moscow, Giessen, Manheim, Upsal, and Trondheim; the Observatories at St. Petersburg and Brussels; the Geological Societies at Berlin and Vienna; The Geographical Society at Paris, and the Astronomical Society at London; the British Association; M. Quetelet, Dr. Jacob Bigelow, Rev. Mr. Barnes, and Prof. Joseph D. Whitney.

A donation for the Cabinet was presented in the name of Captain Stellwagen, of the U. S. Navy. A description of the curious figures on this stone, and the history of its discovery, were promised by the donor.

Mr. Robert P. King, of Philadelphia, presented, through Prof. Trego, an Indian Pestle, found in White Deer Creek, Union County, Pa., on which Mr. Peale made some pertinent remarks.

Mr. Lesley read a letter from George A. Belcourt, Prêtre, dated Rustico, Prince Edward Island, January 1st, 1866, and another from Prof. Edward Ballard, dated Brunswick, Maine, respecting a François-Odjibowe dictionary.

Father Belcourt explains that he had not constructed a corresponding Odjibowe-François dictionary on account of the cost of printing, thinking that the Fr.-Odj. form would suffice for a time. "In con-

sequence," he adds, "I have designed the etymology French and Indian in this volume, which should have been, according to order, in their respective volumes. Should this make a difficulty, I could undertake the volume Odjibowe-François, but it would take some time, and some expenses more for the printing, though I agree that it is desirable.

"I wish to know how many copies could be given to me, and if it would be allowed to take as an indemnity for my time and labor any help that might be offered to me for the end of encouraging the publication of this work?

"I am ready at any time to send you some specimens of the work, and I am ready to answer any questions on the matter. . . . . ."

On motion of Mr. Barnes, the Secretary was instructed to correspond further with Father Belcourt and with Prof. Henry, Secretary of the Smithsonian Institution, on the subject, as it was understood that Father Belcourt had already corresponded with the Institution for the purpose of publishing the dictionary.

A communication on the nature of terrestrial magnetism was read, signed William P. Jones, 456 Franklin Street, Philadelphia, in which the author promised to lay his reasons before the Society in another communication.

A tertiary shark's tooth was presented by Mr. Fraley, with a note dated Schuylkill Haven, August, 1865, signed T. C. Juliet, stating that the tooth had been found in a piece of coal at that place by a boat captain. Dr. H. C. Wood expressed his conviction that it came from the tertiaries of New Jersey.

On motion of the Secretary it was ordered that the Maine Historical Society, at Brunswick, and the Portland Natural History Society, be placed on the list for the Proceedings.

Pending nominations Nos. 541, 547, 548 were read.

Mr. Peale reported that the Magellanic medal was ready to be bestowed.

The Secretaries reported that they found the Zeisberger MSS. Volumes catalogued in the Trans. Hist. and Lit. Committee of the A. P. S., p. xlvii, xlviii, and marked as deposited by the Society United Brethren at Bethlehem.

On motion of Dr. Coates, the Librarian was instructed to

ascertain the views of the S. U. B., as to permitting the publication of the MSS. by the A. P. S.

After which the Society was adjourned.

Stated Meeting, March 2, 1866.

Present, twenty-three members.

Dr. Wood, President, in the Chair.

A letter accepting membership was received from Mr. T. S. Blair, of Pittsburg, dated February 21st, 1866.

A letter of envoi was received from the Royal Academy, dated Amsterdam, June 26th, 1865.

A letter was received from the Secretary of the Pennsylvania Historical Society, December 28th, 1865, requesting duplicates to supply deficiencies in the list of publications of the American Philosophical Society in the Library of the Pennsylvania Historical Society. On motion of Professor Cresson, the Secretaries were instructed to correspond for further information.

A letter was received from Dr. Le Conte, chairman of a "Committee of the Academy of Natural Sciences of Philadelphia, appointed to confer with committees that may be appointed by other learned societies in Philadelphia, who may desire to co-operate in the erection of a building to receive the libraries and collections of the participating societies," dated March 1st, 1865.

Donations for the Library were reported from the Royal Academy at Amsterdam; the Geographical Societies at St. Petersburg and Paris; the Bureau of Mines; Dr. Von Martius; Prof. W. R. Ware, of Boston; the Harvard Alumni; the Boston Natural History Society; the New York Lyceum of Natural History; the Franklin Institute, Academy of Natural Sciences, Mercantile Library, and Institution for the Blind, at Philadelphia; and the University of Michigan.

Two communications on Terrestrial Physics were read,

signed W. P. Jones, dated Philadelphia, 2d month 22d, and 3d month 2d, 1866.

Mr. Cresson described an Auroral display observed by him when at Pottsville, Schuylkill County, on the night of February 20th–21st, between the hours of two and three A. M.

The eastern half only was visible from his point of observation.

The arch was well defined and nearly stationary along its lower margin or intrados.

The eastern extremity rested on the horizon at the point where Altair was then rising, and the crown was in Cassiopeia at about 10° of meridional elevation. The width of the permanent arched band was nearly 15°.

There were but few streamers projected at rare intervals from the arch, but copious billows of white light rolled from its upper margin toward the zenith, some of them continuing visible after separating from the arch and rolling to an elevation of 70° or 75°, involving the whole of Ursa Minor then at its highest culmination, and Lyra and Corona Borealis. Sometimes the billows of light seemed to originate at these lines of extreme altitude and rolled down toward the arch, meeting the billows travelling upward. The degree of illumination measured by shadow within my apartment was about equal to that cast by the moon at half full.

Mr. Chase drew the attention of the members present to the paper of Mr. Glaisher, of London, upon magnetism, and the debates which it gave rise to, reclaiming for himself priority in the publication of similar views.*

Pending nominations Nos. 541, 547, 548 were read.

The President then presented the Magellanic medal to Mr. P. E. Chase, to whom it had been awarded.

Dr. Bell, the Chairman of the Library Committee, reported that at a meeting of the Library Committee, held March 2d, 1866, it was on motion resolved,—

That it be the duty of the Chairman to recommend to the Society at its next meeting, to proceed with the printing of the Catalogue of the Library, Part II, consisting of 189 manuscript pages.

Which report, on motion of Mr. Price, was accepted, and the recommendation adopted.

* See *ante*, vol. ix, pp. 346–8.

On motion of the Vice-President that the letter of Dr. Le Conte be referred to a special committee to consist of the members of the standing committees on Finance and on the Hall, Dr. Le Conte was called upon for a history of the formation of the Committee of the Academy of which he was chairman, and the subject was thereupon discussed by Mr. Barnes, Mr. Price, Mr. Fraley, Dr. Bell, and Mr. Peale. Mr. Fraley's amendment that the presiding officer appoint a special committee of seven, was accepted by Mr. Cresson, and adopted. The President then appointed the following members: Mr. Fraley, Mr. Cresson, Mr. Price, Mr. J. F. James, Mr. Marsh, Mr. Peale, and Mr. Chase.

Mr. Fraley made a statement respecting the correspondence of the Society with the Society of United Brethren, stating that the latter desired to regain possession of the Zeisberger MSS. in order to publish them under their own auspices.

And the Society was adjourned.

Stated Meeting, March 16, 1866.

Present, fourteen members.

Dr. Wood, President, in the Chair.

Letters of envoi were received from the Royal Academy at Lisbon, dated November 26th, and the Haarlem Society, January 30th; the latter requesting to have certain deficiencies in their set of A. P. S. Trans. and Proc. supplied; which, on motion of Mr. Fraley, was so ordered.

A letter respecting the Zeisberger MSS. was received from H. A. Brickenstein, dated Bethlehem, March 7th, 1866.

A letter respecting the Odjibowe-François Vocabulary of Father Belcourt, and other matters, was received from Joseph Henry, dated Smithsonian Institution, Washington, March 8th, 1866.

Donations for the Library were received from the Royal Academy at Lisbon; the Society at Lille; the Royal Astronomical, Meteorological, and Statistical Societies of London; the Essex Institute and Harvard College; Professors Zante-

deschi of Padua, Brush and Johnson of Yale, and Winchell of Ann Arbor; Messrs. Alex. Agassiz, and Shaler of Cambridge; Dr. C. M. Wetherill; Dr. Kirkbride, Mr. Barnes, Mr. Lea; Dr. Mackall, of Washington, and Mr. Blair, of Pittsburg; and the Chicago Academy of Sciences.

The death of G. Forchhammer, of Copenhagen, in December last, was announced by the Secretary.

The death of Dr. Jared Sparks, of Boston, on the 14th inst., aged 76, was announced by Mr. Fraley.

A paper was presented for publication in the Transactions entitled the Hydrology of the St. Lawrence, by Thomas E. Blackwell, Esq., and referred to a committee consisting of Mr. Trautwine, Mr. Lesley, and Mr. Cresson.

Mr. Levi W. Groff, of Bareville, Lancaster County, Pa. (present by invitation), exhibited a watch, on the back of which was engraven, Ben. Franklin, 1776.

Dr. Wilcocks spoke of the present appearance of the zodiacal light.

Pending nominations, Nos. 541, 547, 548, and new nomination, No. 547, were read.

And the Society was then adjourned.

Stated Meeting, April 6, 1866.

Present, nineteen members.

Mr. Peale in the Chair.

A letter accepting membership was received from Dr. Ferdinand Keller, dated Zurich, February 19, 1866.

A photograph of C. D. Arfwedson was received from Dr. Wood.

Letters of invoice were received from the Royal Society of Victoria, dated Melbourne, June 12th, 1865; the Physical Society, Berlin, December 4th; the Royal Saxon Society, Leipsic, September 2d and 30th; the Vaudois Society, Lausanne, September 1st; the Zoological Society, Frankfurt am Main, January 1st, 1866; the American Oriental Society,

New Haven, April 2d, 1866, and the American Pharmaceutical Association, Philadelphia, March 1st, 1866.

A letter requesting the supply of deficiencies was received from the Royal Society of Edinburgh, November 1st, 1865.

A letter establishing correspondence was received from the Maine Historical Society, March 20th, 1866.

A letter requesting exchanges was received from the Museum of Comparative Zoology at Cambridge, March 27th, 1866. On motion, the request was referred to the Publication Committee, with power to take order.

Donations for the Library were received from the Economical Society, Königsberg; Physical and Geological Societies, Berlin; Royal Saxon Society; Geological Institute, Vienna; Societies at Göttingen, Wiesbaden, Frankfurt, St. Gallen, and Lausanne; Frederick Müller, at Amsterdam; the Imperial Observatory at Paris; the Royal Institution of Great Britain and Ireland; the Geographical, Chemical, and Zoological Societies, and Society of Arts, at London; the Royal Observatory, Greenwich; Royal Society, Edinburgh; Royal Irish Academy; Quarterly Journal of Science, Dublin; Royal Society of Victoria, at Melbourne; the Essex Institute and Boston Society, New Hampshire; Public Library at New Bedford; American Oriental Society, Bureau of Mines, New York; Franklin Institute, Mercantile Library Company, and American Pharmaceutical Society, at Philadelphia; Library Associations at Cincinnati and San Francisco, and the Coast Survey Office at Washington.

The Committee on Mr. Blackwell's memoir, entitled "The Hydrology of the St. Lawrence," made their report, which was adopted, and the memoir ordered to be printed in the Transactions.

A paper was offered for publication in the Proceedings, entitled "Sophocles," by Ch. W. Zaremba, M.D., St. Joseph, Michigan, which, on motion, was referred to the Secretaries with power to act.

A map was offered for publication in the Transactions, entitled "A map to illustrate five topographical types of earth-surface between Cincinnati and the sea," by J. P. Lesley,

which, on motion, was referred to a committee consisting of Professor Kendall, Dr. Ruschenberger, and Dr. Hayden.

Mr. T. P. James called the attention of the Society to the second edition of the "Musci Boreali-Americani sive specimina exsiccata muscorum in Americae Rebuspublicis Fœderatis detectorum, conjunctis studiis W. S. Sullivant et S. Lesquereux," which he took pleasure in exhibiting as the labor of fellow members, remarking that the set comprised 536 species and varieties, together with 123 duplicate packets, displaying a rare collection of the Bryological flora of North America, including of course the California mosses described by Mr. Lesquereux, and published in the thirteenth volume of the Transactions of the Society, exquisitely put up; the merit of which, he said, did not consist solely in the beauty of the specimens, but in the accuracy of the nomenclature, emanating as they do, from a source that is authority on this subject.

The time consumed in collecting and preparing so many plants, all carefully, critically, and microscopically investigated, is illy requited by the price fixed for disposal, viz., thirty-five dollars in gold.

Mr. James embraced the opportunity to show two important works on the same subject recently published by Mr. Sullivant,—one in elephant folio, accurately describing the Musci of the Wilkes' U. S. Exploring Expedition, and elaborately depicting fifty-six new species on twenty-six plates, each highly magnified, and with complete analysis. The other, the "Icones muscorum," in royal octavo, describing and figuring mosses peculiar to North America, not heretofore figured, embraced on 129 copper-plate engravings, in like manner produced in the highest state of the art of engraving.

Mr. James thought it a fitting occasion thus to present and allude to the rapid strides that science was making in this direction, owing almost solely to the energy of those two gentlemen, who have devoted so much valuable time, skill, and means to its advancement.

Mr. Peale exhibited permanent soap-bubbles, made from oleate of soda and glycerine.

Mr. Eli K. Price read the following obituary notice:

Oswald Thompson was born in Philadelphia, on the 17th day of December, 1809. His parents were highly respectable. His father, John Wallace Thompson, came here early in life from the north of Ireland, and pursued a mercantile business successfully in the southern part of the city. He took an active interest in public affairs, was a member of city councils, conservative in his political opinions, and enjoyed through life a reputation for probity. To his son he afforded good opportunities of education; sent him to Willy and Ingell's school, and, at the age of fourteen years, to Princeton College. The son profited well by these advantages, and graduated in 1828, with the first honor.

Oswald Thompson entered the office of the Hon. Joseph R. Ingersoll, on the 26th day of March, 1829, who was then engaged in a large practice, having then, as before and since, numerous students, who have become distinguished at the bar and on the bench. Here young Thompson formed valuable friendships which he never lost. He was admitted to the Philadelphia bar on the 27th of March, 1832. His success in practice was early, respectable, and remunerative. His clear judgment, ample learning, and reliable integrity, secured him fast friends and clients; some of them of wealth and influence, who were wise enough to appoint him executor of their wills. It cannot be doubted, had he remained at the bar, that he would have been the recipient of professional business and trusts sufficient fully to occupy his time, and to secure for him independence and wealth.

But Mr. Thompson was not a stranger to the impulses of an honorable ambition, and the desire to be usefully distinguished. He listened to the solicitation of friends to permit his name to be offered to the public as a candidate for President Judge of the Court of Common Pleas of the County of Philadelphia; was nominated and elected to that office; and with his legal friends, William D. Kelley and Joseph Allison, as his associates, took his seat in that Court on the 1st day of December, 1851. It was an office of high importance and responsibility, demanding for the fulfilment of its duties not only great and diversified professional learning, but a fearless independence and courage. The arbiter between human life and death must be a firm man, and should be eminently good; for he must decide upon that life with the fearful responsibility that he shall never sacrifice the innocent, nor suffer the guilty to escape to repeat his murders; and must judge as he knows he must be adjudged before a higher tribunal.

Judge Thompson possessed the requisite personal qualities demanded by his high position, and these never failed him until his health and body sank beneath the weight of his burdens.

He took his seat subject to the disadvantage of following a predecessor of eminent ability, great learning, and laborious study, whose decisions fill several volumes belonging to the profession, and are characterized by great research and power. Judge Thompson was subject to the further disadvantage of having to transact an increased amount of judicial business, a very large proportion of which necessarily consumed much time without requiring the application of much learning, and, therefore, affording little opportunity to exhibit, or incentive to extend, legal research and learning; while the time for elaborating opinions in important cases was curtailed by its consumption in the despatch of the inferior business of the Quarter Sessions and Common Pleas.

The jurisdictions administered by the Judges elected to the Common Pleas of the County of Philadelphia are of the most varied character, and in the aggregate surpass in their diversity and also in their minuteness and magnitude, those of any other court in our State, and probably those of any in the United States. Those Judges try and decide every variety of civil causes, and every grade of criminal offences. They hear the appeals from the Magistrates, involving sums from a few dollars up to a hundred, and have an original jurisdiction up to five hundred dollars. They decide landlord and tenant cases of all amounts; they decide upon all cases of insolvency and assignments, honest or fraudulent, of the poorest insolvent, and the largest corporation of millions of capital as well; and upon the forfeiture of bank charters, and upon the validity of other charters and corporate proceedings. They decide upon the estates of all decedents and minors, real and personal, from the smallest to the largest counted by millions, upon the validity of wills, and their interpretation; decide when and what estates shall be sold for the payment of debts, or to meet the wants of families; hold all executors, administrators, guardians and trustees to account, and upon all differences between them and those interested, and who are entitled by will or statute, as legatees, devisees, distributees and heirs. They are to judge when estates fettered by settlements and trusts, or belonging to persons under disability, may be sold and converted into money, or may be improved for the advantage of those interested and their greater productiveness. By the writ of *habeas corpus* they relieve those unlawfully restrained of their liberty; they protect infants, and decide

which of estranged parents shall have their custody, as the best welfare of the child may require. They decide upon the validity of marriages, and for cause dissolve the bonds of matrimony. They must decide upon the validity of the local elections; review the ballot-boxes, declare which candidate is entitled to the office; and in the midst of high political excitement must forget that they know any preference of party, and decide fearless of threats and impervious to flattery. They must decide upon all plans presented by the Survey department of the City for the extension of the City plan; and upon the opening, narrowing, or vacating all streets, and the assessment of all damages for all property taken by the law of eminent domain for streets, railroads, and parks, that justice shall be done between the owners and the public. They appoint the revisors of the taxes, and must hear appeals as to the liability of property to taxation, and the proper valuation thereof. They participate in the appointment of the Prison Inspectors and Guardians of the Poor and Board of Health; and have a supervisory visitatorial power over the Prisons, Almshouse, and Houses of Refuge. As a Court of Quarter Sessions the same judges try all the lower grades of crime, and commit children to the Houses of Refuge, and, as a high Court of Oyer and Terminer, they try all felonies and capital cases. Here then is the great central tribunal where all interests and the peace and security of this community are protected and maintained; whose conservative power all, at all times, feel, though many may never enter a court; but there many times through life their personal interests may be deeply involved, and there, as certainly as death, shall come their estates for legal transmission and adjudication. This summary enumeration of subjects of adjudication is now and here made, because the public should understand what is done for them by the Courts, and because it is a survey necessary to complete the great lesson of justice to be taught us all by the judicial life and the premature death of Judge Thompson.

It is not here that we should enter upon a criticism of the many judicial decisions made by Judge Thompson. The members of the legal profession will find these, so far as written and published, in the several volumes of the "Philadelphia Reports," for the past fourteen years. It will suffice here to state the characteristics of those opinions. They partake of the character of their author. He who was ever calm, self-possessed, patient, seeming to sit the impassive impersonation of justice; he who was conscientiously faithful, truthful, laborious and learned; he who loved justice, hated iniquity, yet had

a heart tempered by mercy, necessarily made his investigations carefully, stated his facts truthfully and clearly, and formed his judgment cautiously; applied sound legal principles pertinently, and drew his conclusions accurately and with a convincing logic. Beyond these requisites, imposed upon himself as indispensable, he seldom elaborated; for the exigencies of the public business which ever pressed upon him did not permit long legal disquisitions. These sensible and clear opinions will long and often be cited by counsel and judges, and hold the memory of Judge Thompson in respect and honor.

Judge Thompson made not his elevated position available to other distinctions. He modestly toiled on in the performance of his judicial duties, and found these more than adequate to task ordinary human endurance. Yet was he not insensible to social enjoyments, and freely mingled with his fellow citizens on social occasions; and was not abstinent from social worship, nor negligent of the claims of his church. He was elected a member of the Historical Society; made a Trustee of the General Assembly of the Presbyterian Church; a Trustee of the University of Pennsylvania; was chosen a member of The American Philosophical Society; and received the degree of Doctor of Laws from the Jefferson College.

In bestowing the patronage of his court Judge Thompson was liberally judicious. His appointments of Masters, Auditors, and Examiners were not confined to a few favorites, but extended generally among the competent junior members of the bar, and to those advanced in the profession when the occasion demanded mature experience and judgment. He was willing to listen to the suggestion of counsel, and often invited it, as to the nature of the questions to arise, and the qualifications needed in the appointee; and probably never declined a nomination mutually agreed upon by the opposing counsel. It was his pleasure to encourage modest merit, to assist those who needed assistance, and many young men owe to his kindness a debt of gratitude. But whosoever the appointee no feeling of favoritism could give his report the slightest immunity against a fair exception and reversal.

Judge Thompson's junior brethren on the bench have borne for his character a warm and affectionate tribute of regard; and they testify to traits of character perceptible to the bar, but more fully manifested to those who were in constant association and consultation with him. One generous characteristic obvious to us all was, that he sought not to arrogate to himself the important business of the Court in a manner to overshadow his brethren; but in free and full

interchange of opinion imparted to them all that he knew, essential to a just and enlightened decision, caring more for the faithful administration of justice and the credit of the Court, than for any personal distinction; and then assigned to them their full share of the cases requiring legal research and written opinion. He was ample in learning, penetrating, and full of resource in grappling with difficult cases, but very cautious, fearing to err; carefully examined the facts and authorities, and with accurate precision considered and applied the proper ruling principles. If sustained by the Supreme Court he was happy for this proof that he had committed no error; if reversed, yet was he happy that no one had suffered by his mistake. His love of justice surpassed his pride of opinion; he was most prompt to correct himself; and upon discovery that the innocent had suffered by false evidence, he was instant to repair the wrong. So careful and cautious was he, that he was well justified in a very firm reliance upon a deliberately formed opinion; and with that confidence fear of consequences vanished; yet so conscientious was he that he was still open to conviction from the sensitive apprehension of doing wrong; and reinvestigation on the suggestion of his colleagues, was sometimes followed by a reversal of himself before his first impressions, and even his formed opinions, had passed into irrevocable judgment.

His brethren and friends also testify to other qualities of the mind and heart, not so obvious to the public, but which serve to complete the character of the man, without impairing the character of the judge. Beneath that calm judicial serenity we beheld, there flowed a current of feeling, which, though it rippled not the surface, was strong in sympathy or indignation, which was sometimes outspoken, as honesty and duty required, in approval or censure. As a companion he was social and genial; as a friend warmly attached and hospitable; with his judicial brethren, sometimes relieving the seriousness of weighty consultation with fitting anecdotes, racy humor, or pungent wit. He had a cultured mind, preserved his classic attainments; added French and Spanish to his Latin and Greek, and kept up with the literature of the times as far as he could without neglecting any public duty. It was among his regrets that he had so much to sacrifice his literary enjoyments. Whatever might be the differences of opinion between himself and friends, these disturbed not their happy intercourse. He was gentle and kind to rich and poor, and wonderfully patient to hear the palliating circumstances narrated by the interceding friends of those whom he was to sentence, or had sentenced, to penal endurance. What

Oswald Thompson was as husband and father I will not dare to delineate, nor venture to intrude upon the hallowed scene of his home, where the wounds yet freshly bleed; but will leave you to form your own high ideal of all that the kind, affectionate, and good husband and father should be, and to assure you, from all I have learned, that that ideal will not surpass the real, of him whom we now most sincerely mourn and honor.

A slight circumstance will indicate the religious and reverential bent and habit of Oswald Thompson's mind. Within the past year, while convalescent, and sojourning at a kind friend's country place, when on Sunday morning some reviews were offered for his amusement, he quietly replied, "I would like something better to-day;" and accepted and read Dr. Barnes' Notes on Isaiah.

But duty compels me here to change the tenor of my remarks, and to ask you and the public to contemplate with me a melancholy phase of the latter years of this eminent and good public servant; that the wrong done to him, to a large extent for want of thought and consideration, may not be repeated and perpetuated upon his judicial contemporaries and successors. By the united testimony of many judges and lawyers, and other witnesses, Judge Thompson has fallen an early victim to overwork, too close confinement in a bad atmosphere, and that with a compensation wholly inadequate; if any could compensate so severe a sacrifice as that of health, happiness, and life itself. Yet although from the bitter tears of sorrow shed upon his untimely grave there now grow bitter plants, let us endeavor to make them medicinal for cure to save health and life in others. So a kind Providence intends; from evil he ever educes good; and commissions the bitter to heal and restore.

At the expiration of the term of ten years, for which Judge Thompson was elected, he was again nominated and elected to the same office. It had then been perceived that his constitution had become impaired by excess of labor, by long confinement in the courts, and by breathing the tainted air of the illy-ventilated Quarter Sessions Court-room. He was warned, by solicitous friends, of the peril he was about to incur by a re-election, as no doubt he had been keenly self-warned by his sufferings. But he had no choice, and then declared his purpose to continue to work on while life should last. He had left his practice, and his clients had become satisfied with other counsel; and no one's lost business would return at his bidding, and if that were possible, could not be sustained with impaired health and strength. His salary, consumed in maintaining

and educating his family, had added nothing to his little capital. It was therefore of necessity that he must continue to perform his judicial functions, though well knowing that they would soon terminate his life. Such is the exigency experienced by all Judges who have not secured their independence before taking office. It is a humiliating concession to make, but it is demanded by truth. We must bear the reproach until we apply the remedy. Judge Thompson is but a more signal example of a pervading injustice. Many Judges there are in our State, eminent for learning and ability, of perfect integrity, on whom we must all depend for the protection of all that we have inherited or shall earn, and for all rights we hold most precious, to whom we render no adequate justice, and who have to suffer repentance and take to themselves bitter reproaches, because they have committed the error of having trusted themselves and their families to the justice of their country. That is a sad reproach, indeed, to all who compose the public of the Commonwealth of Pennsylvania.

Let us try a statistical statement between the period of Judge Thompson's judicial life and previous periods, and thence judge whether we have not been greatly unmindful of our duty, by not keeping more consciously awake to the growth of our community and its more than commensurate increase of business for the Courts. Let us do this in reference to our local State Courts, leaving out of view the Supreme Court, which has existed through all those periods, besides formerly, in each year, holding the Court of Oyer and Terminer here, which they have not done in this county for many years, by reason of the increased amount of business devolved upon those Judges.

In 1790, the population of Philadelphia County was 54,391; in 1800, was 81,009; in 1810, was 111,210; and at those periods, our local courts were two, the Common Pleas, with three Judges, one of them learned in the law, and the Mayor's Court, with a Recorder, learned in the law, assisted by the Mayor and Aldermen. The District Court was created in 1811, with three Judges, one of them learned in the law; and since 1821, all of them have been learned in the law. In 1820, our county had population, 137,097; in 1830, had 188,789; in 1840, had 258,037. Our local courts stood without change until 1840, except that in 1834, a second Law Judge was appointed in the Common Pleas, and in 1836, a third Judge, learned in the law, was appointed for that court; and except also that, in 1838, another court, called the Criminal Court of Sessions, was es-

tablished, with three judges, learned in the law. The court last named was, in 1840, superseded by the Court of General Sessions, composed of three Judges, learned in the law; and in 1843 that court was, in turn, abolished, and its jurisdiction restored to the Court of Oyer and Terminer and Quarter Sessions, with the addition of a fourth Judge, learned in the law, for those criminal courts and the Common Pleas; which number was reduced to three in 1851, and so has since remained, during all the judicial life of Judge Thompson. The jurisdiction and powers of the Mayor's Court had been absorbed by the criminal courts established in 1838 and 1843, and were conferred upon the Court of Quarter Sessions in 1843. We have had, since 1851, but the same number of courts that we had in 1811, and in that time have had but six Local Judges, learned in the law. In 1850, the population of our county had risen to 408,762, and in 1860, to 565,529. Counting but the Law Judges of former times as effective for the despatch of business, the two for the average of the populations of 1790, 1800, and 1810, would give, in proportion to population in 1860, fourteen Judges, instead of the six we have. The three Law Judges, from 1811 to 1821, would give, by the same rule, in 1860, thirteen Judges; the five, in 1830, would, in 1860, give fifteen; and there being, in 1840, nine Law Judges for a population of 258,037, these, by the same proportion, would give, in 1860, twenty Local Judges, instead of the six we have. If, then, former numbers had any just relation to the business to be transacted, we have been grievously unjust and oppressive in the amount of the labor we have heaped upon the Judges of the Court of Common Pleas and District Court of the County of Philadelphia. We have alike been unjust to ourselves; for when the Judges are compelled to do more than they have time to do, business cannot be so well done; justice to some extent is sacrificed; and rather than wait the delays necessarily incident to the choked channels of justice, people submit to unjust compromises; they abate their just rights, rather than endure the law's delay.

Can any one imagine a position more painful to a cultivated and sensitive mind than that of Judge Thompson, during the latter years of his life? He had no adequate resources for his family, while his salary was consumed by the necessary current expenses. He labored on with a keen sense of his duties to the public; felt the keener as failing health increased his nervous sensibilities; and determined that none of his labors should fall upon his overtaxed brethren; yet perceiving, from day to day, that his bodily constitution was fast failing

him, and the more rapidly as the mental labor and anxiety were accelerating the work of destruction. As the body yielded to the pressure, the resolved mind, by a more than natural energy, essayed to supply the loss of physical strength. The edges of the diamond were but the faster cutting away its inferior setting. He fell prostrate in insensibility, and the consequent constrained rest, in the course of months, wrought partial recovery. At the commencement of the last autumn's business he resumed his judicial functions, with his wonted clearness of mind and ceaseless industry. The energetic mind seemed then unconscious how much it was transcending the sustaining capacity of the impaired body. Again he fell, but now to rise no more. On his way towards his judicial seat, though medically advised, and by one of his family affectionately entreated, to remain at home, he was again stricken, carried home, and within a few days expired. The frailer body utterly succumbed to the indomitable will. He died January 23d, A. D. 1866. This may now be added to the many proofs of the mind's predominating power over the body; to the evidence that one is immortal, the other mortal, as they part in death. We may add too his to the countless cases of deaths hastened by excess of labor, or trouble, or sorrow. All-conquering labor at last conquers the laborer, and "by sorrow of the heart the spirit is broken."

The writer asks to be pardoned for thus dwelling upon the sad surroundings of the last years of the life of our fellow-member and friend; sad from two causes only, in which the account and accountability are solely between him, as a public servant sacrificed, and that public of which we all are part; for in all else, except more ample fortune, he possessed all that could make a good man happy: for he was happy in the respect and regard of all who knew him; happy in his own good character and conscious rectitude; happy in the love of friends, family and home; happy in the enjoyment of his religious faith and worship, in the love of his God and trust in his Saviour's power and will to save. He was only not happy in that he was oppressed by inordinate public burdens; that he was inadequately compensated, and foresaw how soon he must be separated from those he most loved, leaving them to mourn his loss, without provision made for their accustomed comforts and enjoyments. Saddest thought is this that can rend the loving parental bosom, when looking narrowly upon the final separation. How little did the public know, as they looked upon the pale, but calm, self-possessed Judge, as he sat daily before them, on the judicial seat, what sorrow, what grief, what

agony, were racking his bosom. He was silent; he spoke no word of complaint, though others sometimes did, for him and his brethren. But now the public know all; and though the victim be beyond their reach now to console and do justice to him, let that public make the amend to his judicial survivors. That would have been the greatest wish and consolation to him, next to his own family's comfort, could he have foreseen the fruits of his own death, which we have seen fulfilled; though what has yet been done inadequately fulfils the demands of justice.

The Judges of all our Courts, and the members of the bar and the public, were moved with an unwonted sympathy when they convened to pay the usual tribute of respect to their departed brother and friend. Without previous concert, they had perceived and with one accord spoke of the cause of the calamity they met to deplore, as well as to honor the memory of the dead. The Bar held subsequent meetings, and sent a deputation to the Legislature, to ask that the great wrong should not be longer continued. The Executive, and Attorney-General, and Committees of the Legislature, made friendly responses. Laws have been enacted to add another Judge to the Court of Common Pleas; additions have been made to the salaries of all the legal Judges of the Commonwealth, and the City Councils are building a better Courthouse. So far, all thus done has been well done; but the wrong has not been fully redressed; the measure of justice has not been reached; and in the name of the honored victim, and in the name of the justice and honor of the Commonwealth, more is demanded; yet another Judge; yet fuller recompense. The occasion has directed our attention to the Judges of the Common Pleas especially; but the same justice is due to those in our District Court and Supreme Court, and others, whose labors have been greatly increased by the increase of population and business in our City and State. The observant eye may see other impaired constitutions sitting on judicial seats; impaired in different degrees from excess of labor and confinement; and we wait but the certain consummation of a slower process, to mourn other judicial victims fallen.

It is not that I would make the judicial office one to be sought for profit, that I am earnest. Those who would seek it from such motive would be unfit for it. The fitly-qualified must have higher and better motives, compared with which the desire of wealth, and wealth itself, are ignoble. Neither would I expect to compensate integrity, learning, and great ability, in the measure of their deserving. The deserts of those on the bench always overflow the limit of the fixed

salary. It is only Judges who are never compensated for high qualities, generous labors, and exalted teachings; while members of the bar, and all others who exert high intellectual and moral qualities, in every calling of life, receive the measure of reward as it flows in generous and ever swelling streams. Let the Legislature, if they please, fix the Judge's salary at but the just equivalent of the mere business requirements of duty, which performed, may do little to advance the science of the law or to elevate the tone of public morality; yet will they do better than they have ever done. Do that by but the rule that squares with the justice measured to other labor and service, according to skill and the cost of educational preparation, and that justice must support the Judge and his family reputably while he lives, and leave something to support that family when the Judge is dead. That measure of justice has not been reached; and it is no excuse to us, the public, that the Judges have been generously willing to take office and meet the sacrifice. Though they have even done so by the promptings of an ambition for distinction, it is not our right to take advantage of the generous or even ambitious aspiration. We are yet wrong-doers and oppressors; and we shall never escape this just impeachment, until we make the salaries cover all the proper expenses of the Judge's reputable living, for each year, and add so much thereto as will, at the end of the judicial life, secure a capital, whose interest will meet the moderate wants of the family, when by death bereft of their head and support, they are left pensionless in the world. The judicial office should not be so poorly paid that the rich only can prudently accept it.

It has been the proverb of ages that Republics are ungrateful. It has been the glory of our nation in this most eventful time, to wipe out that reproach, by an exhibition of sacrifices and philanthropy, such as the world had never known, and could not have imagined. All classes of persons, if we had classes, became fused into a universal brotherhood and sisterhood of charity, for the relief and comfort of the defenders of our Government. From men, women and children money flowed as water from numberless rills of mountains and hills, and the swelling streams dispensed countless beneficences. If we had an aristocracy it was melted down by a common sympathy and patriotism; exclusiveness forgot its cold reserve; selfishness ceased to be saving; and wealth and personal service became a common offering to our beloved country in peril. Yet are we in one thing still ungrateful; and worse, for we are unjust. We have public servants set aside to a special service, whom we exclude from all other oppor-

tunity of business and profit; prepared for that service by long labor and expensive education; Judges, intelligent, learned, faithful, patriotic, who serve us alike during all the years of war and peace, precisely in that direction wherein our rights, liberties, and Government are most surely to be protected and maintained. These public servants, in all British and American history, have been the champions of true liberty; of that liberty which consists in the security of all rights; have been statesmen, whose legal policy, wisdom and firmness made them staunchest opponents to that aristocracy which would build up family power, at the expense of the welfare of the body of the people, by fettering estates in perpetuity. In this country of constitutions their powers transcend those of all other judges; for they are the ultimate protectors of the liberties and property of the people against all legislative, executive, and military usurpations. We have Judges of our Courts, who may, perhaps, have listened imprudently to ambitious suggestions of distinction, and thought of the dignity of elevated position, and yet have brought to the discharge of their high and most responsible duties, irreproachable character, ample learning, and exalted talents, who only were unwise in committing themselves and families to the justice of the Commonwealth. Impute this to them as folly, if we will, yet such imputations made by others cannot equal their own often-felt, bitter, self-reproaches; but self-reproaches felt for no wrong of theirs, but only because they had trusted to the public justice, and found it to fail. How tenfold more severe then should be the self-reproaches of that public! The judges in their younger life may have felt the impulses of an honorable ambition; the aspiration to make their lives usefully distinguished. Yet are these the impulses of generous and exalted minds. Without them human nature would be shorn of its chief glory. They may have expected to make sacrifices, and would bravely bear the penalty of their aspirations, receiving little of our sympathy, had they no family to look upon in sympathy for their welfare; and could they cease to think of what shall become of that family, when by the family's greatest calamity, the present inadequate salary must wholly cease, with no fortune provided for them. Whatever the motive or aspiration of the Judge, we, the public, receive full, laborious, generous service, and not justly to requite that service is a wrong, the responsibility of which we cannot shift from ourselves. We let it fall too lightly upon each of us, as it disperses itself upon the millions of our population; but we should make it concentrate again upon our representatives in the legislature, until they shall do the

judiciary justice, and do us, the people, justice; we, who, as well as they, bear the odium of the just impeachment of public ingratitude and injustice.

Could we now and forever redeem our Commonwealth from this impeachment, the too early death of Oswald Thompson, so hard for him, so cruel to his family and friends, will not have been in vain. His life was spent in administering justice; it was sacrificed by his devotion to the duty of pronouncing and executing justice; and it is most fitting, since the great sacrifice has been endured, that his death should achieve a yet further great and enduring justice.

Oswald Thompson lived and died in the Christian faith, worshipping in the Presbyterian Church. He believed in his own immortal being, and all who loved him, alike happy in their faith, have the consolation of a confident assurance of reunion with him in a happier existence. His was that highest philosophy, whose beneficent fruits prove it both good and truthful; whose faith has power to disarm death of terror, and make it a triumphant entrance into endless happiness; the philosophy given to the world by Him who "brought life and immortality to light through the Gospel."

Mr. Chase referred to some interesting views upon subjects involving the relations of cosmical and molecular forces, in Mr. Ferrell's paper, "On an Annual Variation in the Daily Mean Level of the Ocean, and its Cause" (Proc. Amer. Acad. A. & S. vol. vii, pp. 31–36), and in Prof. F. Guthrie's "Speculation concerning the Relation between the Axial Rotation of the Earth, and the Resistance, Elasticity, and Weight of Solar Æther" (Phil. Mag. [4] 31, 210–213).

Mr. Chase also presented a summary of his observations on the comparative visibility of Arago's, Babinet's, and Brewster's neutral points.

In my communication of January 5th, I stated that when Brewster's neutral point is above the horizon, I had frequently determined its position with great ease. My experience was so different from those of Brewster and Babinet, that I commenced on the 6th of March a series of comparative observations upon the three neutral points. The month which has just ended appears to warrant the following conclusions for stations in Philadelphia and its vicinity. The 1st, 2d, and 6th seem to be confirmed by observations elsewhere, while

the 3d, 4th, and 5th, which are, perhaps, dependent partly upon local atmospheric peculiarities, have never, so far as I am aware, hitherto been noticed.

1. Arago's neutral point often assumes a distinctness which is never exhibited by either of the others, merely because the polarized bands in the vicinity of the sun are obscured by the dazzling brilliancy of its rays.

2. For the same reason, Babinet's neutral point is often better defined, in the morning and evening, than Brewster's during the middle of the day.

3. But when Brewster's and Babinet's neutral points are both above the horizon, if the sky is clear, the former is generally *more easily* posited than the latter. This is especially the case at midday.

4. On every clear day, and on a large portion of the days which are partially obscured by clouds, the position of each of the neutral points can be determined. Brewster records but two days during five years' observations (Phil. Mag. [4] 30, 124), upon which he saw all the points.

5. Arago's neutral point often rises before Brewster's sets. Under favorable atmospheric conditions the three points are, therefore, sometimes simultaneously visible.

6. Halos and clouds are frequently discernible through the polariscope, which are invisible to the naked eye.

The following abstract embodies some of the results of the month's observations:

Satisfactory observations were made on	25 days.
All the neutral points were seen on	17 "
There were no satisfactory observations on	6 "
" " 39 observations of Arago's neutral point on	23 "
" " 93 " " Babinet's " " "	22 "
" " 59 " " Brewster's " " "	20 "
Arago's neutral point was remarkably distinct on	4 "
Babinet's " " " " " "	10 "
Brewster's " " " " " "	11 "
Arago's was the only one observed on	2 "
Babinet's " " " " "	1 "
Babinet's and Brewster's the only ones seen on	1 "
Arago's and Babinet's " " " "	2 "

The three points were simultaneously visible on April 5th, from $4^h\ 32'$ to $4^h\ 42'$ P. M.

Brewster's neutral point was perceptibly more distinct than Babinet's at fifteen observations, and less distinct at two observations.

I subjoin a few of my notes, which refer to points of special interest: March 8th, 5^h 45′, P. M. Near the proper position for Arago's neutral point, the positive and negative polarities coalesce upon clouds, with no intervening space or neutral line.

March 9th, 6^h 25′, A. M. Hazy and polarization fluctuating. 10^h 40′, A. M. The polariscope showed a brilliant halo around the sun, which I had not before noticed, but which was afterwards barely visible to the naked eye. 12^h 10′, P. M. Haze continues. Negative polarity remarkably distinct over the face of the sun, and for several degrees north and south.

March 11th, 3^h 50′, P. M. Sky covered with thin clouds. A neutral point in the east, 42° above the horizon, and *more than* 70° *from the anti-solar point*, with reversed polarization, or positive below, and negative above. 5^h 25′. A similar point still observable, but about 5° nearer the horizon.

March 12th, 6^h 30′, A. M. Cloudy. Polarization positive from east and west horizon, nearly to zenith. A similar observation was made March 21st, at 6^h P. M.

March 17th, 9^h 15′ and 10^h 40′ A. M.,* and March 18th, 10^h 30′, A. M.† Very clear. Sun so bright that I was unable to detect the negative polarity between Babinet's neutral point and Brewster's, even by screening the eye from the direct light of the sun.

March 19th, 11^h 5′, A. M.‡ Halo, visible only through the polariscope. 1^h P. M. Snowing.

March 20th, 5^h 25′, P. M. Cloudy. Polarization in horizon everywhere positive.

March 24th to 28th, inclusive. On each of these five successive days Brewster's neutral point was remarkably distinct and beautiful.

April 3d, 5^h 40′, P. M. Cloudy in west, and polarization positive from zenith to horizon.

Strong reflection sometimes changes the character of a comparatively weak polarization, from positive to negative, or *vice versâ*. A fainter reflection, by showing whether the bands are interrupted or continuous, often aids in determining the character of the polarization.

The increased refraction of a piece of glass, interposed between

* On steamboat in Raritan Bay. † At Eagleswood, near Perth Amboy.

‡ In New York.

the polariscope and the sky, will frequently show a neutral point which is otherwise invisible.

The normal polarity is often reversed by a stratum of clouds of uniform thickness, especially within the solar primary lemniscate.

Pending nominations 541, 547, 548, 549, were read.

On motion of Mr. Fraley, the subject of Dr. Genth's conditional donation of ten volumes of Leonhard & Bronn's Jahrbuch für Mineralogie 1840–1851, was referred to the Library Committee with power to act.

On motion of the Librarian it was resolved that the Secretaries be authorized to subscribe for the Bulletin International de l'Observatoire Impérial de Paris.

And the Society was adjourned.

Stated Meeting, April 20, 1866.

Present, twenty-three members.

Dr. Wood, President, in the Chair.

A letter of envoi was received from the Geological Bureau of Sweden, dated Stockholm, November 6th, 1865.

Donations for the Library were received from the Geological Survey of Sweden, the Geographical Societies of France, the Royal Astronomical and Meteorological Societies of London, the Bombay Branch of the Royal Asiatic Society, the Boston Natural History Society, the Rhode Island and New Jersey Historical Societies, the Franklin Institute, and the Publishers of the Medical News, Philadelphia.

The Committee to which was referred "a Map representing five types of topography," reported in favor of its publication in the Transactions, which, on motion, was so ordered.

Dr. Le Conte exhibited a piece of lithographic stone found in Northern Alabama, similar to the hardest or blue variety of German stone, from a quarry used by the Rebel Government for printing its treasury notes, specimens of which accompanied the stone.

Mr. Lesley read extracts from letters respecting the discovery of oil on the Alleghany River at Brady's Bend, seventy miles above Pittsburg, and twenty miles below Franklin in Venango County, and exhibited a suite of specimens of the strata bored through, and the oil obtained.

The place of the Brady's Bend boring is shown in Plate 2 of this Volume of the Proceedings, and its relations to the Venango County Oil Sand Rocks described on pages 56, 57 above. A careful calculation, based upon observations at the locality in the spring of 1865, when the well was commenced, gave 700, 900 and 1100 feet for the respective depths of the three Venango County Oil Sand Rocks (if they extended so far as Brady's Bend) beneath the level of the river.

The depth of 700 feet was, however, reached and passed with no show of oil. The first sand rock therefore seemed to be absent beneath the Brady's Bend locality, or to be destitute of petroleum.

But at 940 feet oil was struck, and with a strong pressure of gas, January 3d, 1866. The bottles show that, from 908 to 1015, all the borings came up stained more or less with oil.

At a depth of 1015 feet the borings became clear again, and the well was stopped at 1089 feet. Seed bags at 381"6 and 425.

Pumping was resorted to and the well produced 25 barrels in 12 hours. It is now reported yielding regularly 12 barrels per day. "The crude oil will burn in a lamp as beautifully as refined oil does, and will continue to do so until the entire contents of the lamp is exhausted." (May 4th, reports 6 barrels per day.)

Whether this oil comes from the second or from the third horizon I do not know; but I suppose the latter. I judge that the oil-shows from 908 to 1015 came from the second horizon at say 900 feet, and that the present depth of 1089 feet marks with surprising accuracy the 1100 foot horizon of the Third or Great Venango Oil Bearing Sand Rock.

Having impressed upon the owners the utility of accurate records of the boring of this pioneer well, I have had the happiness to receive 61 bottles of borings, giving the appearance and condition of the strata from a depth of 142 feet (above which no record was kept) to the bottom of the well. From these bottles the following section has been prepared:

1.	Sandstone;	not very coarse; rising in pieces;	yellowish; at	142	feet.
2.	" "	finer,	orange,	22 to	164
3.	" "	finer,	reddish orange,	4 to	168

4. Sandy shale; in powder and pieces;	gray,	12 to	180
5. Sand stone; very fine;	yellowish,	19 to	199
6. Sand stone; muddy; in pieces;	yellowish,	2 to	201
7. Sand stone; muddy; in powder;	orange,	1 to	202
8. Shale; very fine;	bluish gray,	15 to	217
9. Shale; very fine and powdery;	greenish gray,	9 to	226
10. Shale (like 4 above) fine, powdery;	light bluish gray.	24 to	250
11. Shale;	darker gray,	40 to	290
12. Shale; fine and powdery;	more greenish than 9,	6 to	296
13. Shale; pretty fine;	yellowish greenish,	12 to	308
14. Shale; fine and powdery;	bluish greenish,	11 to	319
15. Shale; pieces and powder;	olive,	8 to	327
16. Shale; all powder;	dove color,	41 to	368
17. Shale; fine sandy (like 4) and large pieces, some powder;	gray,	3 to	371
18. Shale; (like 13) but finer; no pieces;	yellow greenish,	19 to	390
19. Shale; (exactly like 17) but all in large pieces;	gray,	15 to	405
20. Shale; (same as last) finer and a good deal of powder;	gray,	120 to	525
21. Shale; (like 18) very fine;	yellow greenish,	25 to	550
22. Shale; (like 17) smaller pieces and some powder;	gray,	5 to	555
23. Shale; (like 17) larger pieces than 22;	gray,	10 to	565
24. Shale; (like 10) but a little coarser and warmer;	blue gray,	25 to	590
25. Shale; a little warmer than last and very powdery;		8 to	608
26. Shale; (like 20 exactly) trifle finer;	cold gray,	1 to	609
27. Shale; silicious; (like last) all in pretty large pieces;	cold gray,	21 to	630
28. Shale; muddy; (like last) a little warmer; pretty large pieces;	cold gray,	10 to	640
29. Shale; (like last) but fine;	cold gray,	30 to	670
30. Shale; (like 18) coarse;	warm gray,	30 to	700
31. Shale; (like last) finer, powdery;	warmer gray,	5 to	705
32. Shale; (not so fine as 31, nor so warm as 30);		10 to	715
33. Shale; (like 25) fine;	cool gray,	5 to	720
34. Shale; (like 26) fine pieces;	cold gray,	20 to	740
35. Shale; very fine; much powder;	somewhat brickdust color,	5 to	745
36. Shale; (almost like 3);	orange,	5 to	750
37. Shale; (like 34) fine pieces;	cold gray,	2 to	752
38. Shale; (like 36) powdery fine;	orange,	3 to	755
39. Shale; (like 19) pieces;	cold gray,	12 to	767
40. Shale; very fine;	greenish gray,	8 to	775
41. Shale; very fine;	warmer gray,	22 to	797
42. Shale; fine and powdery;	not quite orange,	3 to	800
43. Shale; (like 40);	greenish gray,	20 to	820
44. Shale; powder (containing large gray pieces);	orange,	3 to	823
45. Shale; fine;	gray,	27 to	850
46. Shale; all in large pieces;	blue gray,	12 to	862
47. Shale; fine;	greenish gray,	23 to	885

48.	Shale; powder holding pieces;	towards orange,	4 to 889
49.	Shale; fine pieces;	greenish gray,	1 to 890
50.	Shale; powder;	dark orange,	18 to 908
51.	Shale; disguised with oil;	dark purple,	10 to 918
52.	Shale; fine; disguised with oil;	purplish gray,	19 to 937
53.	Shale; fine; " " "	dark green gray,	8 to 945
54.	Shale; fine; " " "	purplish gray,	10 to 955
55.	Shale; sandy; " " "	brownish green,	39 to 994
56.	Shale; sandy; " " "	brownish green,	10 to 1004
57.	Shale; sandy; " " "	brownish green,	9 to 1013
58.	Shale; sandy; " " "	Spanish brown,	2 to 1015
59.	Sandy shale; " " "	very dark green gray,	9 to 1024
60.	Sand stone; soft, whitish, making a yellow sand,		41 to 1065
61.	Sand stone; hard, white, making a gray powder,		24 to 1089

It will be seen by comparing the above section with that of the Sligo Salt Well, furnished by Mr. W. W. Lyon (April 7th, 1865, page 63 above), that the opinion I expressed then was correct, viz.: that the reason of the non-productiveness of the Sligo Well, and of the Clarion River region generally, was merely due to the fact that the Sligo Well, although 992 feet deep, really has penetrated the Brady's Bend strata only 800 feet, and therefore has stopped short of the third and chief oil horizon of Venango County by nearly 300 feet. I believe that, were the Sligo Well to go down this additional distance, it would yield the same petroleum and in the same quantities that the Brady's Bend Well is said to yield.

I cannot say that any accurate identification of corresponding strata in the two wells has been made out. The record of the Sligo Well is from the report of the well master, who describes the look of his borings as they are brought up in the sand pump. The record of the Brady's Bend Well is from the dried sands and powder and fragments of borings preserved in bottles. To obtain a fair comparison and identification, there is but one way, viz.: to bray the borings in a mortar and ram them into a glass tube; giving to each kind of borings as many tenths of inches of glass tube as the borer found feet of the rock; and wiping out the tube after every fresh charge, so as to keep the inner surface transparent. If this be done carefully, and the charges are well rammed down to the exact depth (marked by an ink line on a longitudinal strip of paper pasted on the outside of the tube), two tubes can be laid side by side, and any real identifiability be instantly detected. There is no reason why every well-house should not keep one or more such permanent records of its well. Some of the tubes might be half-inch, for dried and powdered borings, to show the color, and others inch tubes, for the fresh wet borings, to show the

grain and fracture. As all the rocks of the Devonian system under the western coal measures are very argillaceous, it is not well to reduce to powder the borings which come from the more sandy layers, because then the prime distinction between sandstones and shales vanishes. And yet it is well to keep one record tube of powdered rocks, because the colored bands come out more plainly thus.

To make a glass-tube record perfectly useful for the study of strata, it is needful to cleanse such borings as come up disguised in color and consistency by oil. After oil is struck (however slight may be its show) all the borings from further down, for many feet and even fathoms, are stained and clotted with the oil, and should be cleansed before being charged into the tube.

Returning to the Brady's Bend Well, the glass-tube record shows belts of orange from 142 to 202; from 371 to 390; from 525 to 550; from 740 to 755; at 797; and from 890 to 908; all the intervals being filled with olive and gray shales:

Supposing the conglomerate at the river bank to be not over 50 feet thick, then the following are the probable identifications of these orange bands:

From 142 to 202 = 60 feet of red rock representing Formation XI.

From 371 to 390 = 19 " " "
From 525 to 550 = 25 " " "
From 740 to 755 = 15 " " "
From 797 to 800 = 3 " " "
From 890 to 908 = 18 " " "

} representing Formation IX; and the Red Band or Mansfield ore, of Formation VIII.

It is impossible to identify these bands more carefully, because we cannot be sure that they represent what are called red shale strata. They may represent comparatively high-colored rocks charged with nodular iron ore, and giving flows of iron rust water. This much is certain; there is no resemblance whatever between this scheme of orange bands in the B. B. Well, and the so-called red rocks in the Sligo Well section.

Plate IV will show the distance and direction from one another of these two wells, and their geographical relations to the Oil Creek region and to Pittsburg.

At the bottom of the map close to the Pennsylvania and Virginia State line will be seen the wells of Dunkard's Creek, sunk through the lower part of the Upper Coal Measures, into the upper strata of the Middle or Barren Measures, below the Pittsburg Coal; as the following record, by Mr. Robert Collyer,* of the Amber Oil Company's (now Amber Gold Mining Company) "Kener Well," on Deer

Run, a branch of Dunkard's Creek, four miles from Greensborough, county town of Greene County, will show:

"Soapstone," [meaning fire clay shale],	25 feet.
Sandstone,	10 to 35
Coal Bed,	7 to 42
Soapstone, [fire clay, or under clay],	23 to 65
Sandstone,	6 to 71
Soapstone, 16;—and again, 19 =	35 to 106
Sandstone,	3 to 109
Soapstone and sandstone,	8 to 117
Sandstone,	4 to 121
Soapstone,	10 to 131
Sandstone, 8;—and again, 33 =	41 to 172
Soapstone,	9 to 181
Limestone,	5 to 186
Soapstone and sandstone, 12 + 17,	29 to 215
Sandstone,	19 to 234
Soapstone,	18 to 252
Sandstone and soapstone,	9 to 261
Coal Bed,	13 to 274
Sandstone, 34;—and again, 14 =	48 to 322
Limestone,	39 to 361
Sandstone,	31 to 392
Black clay,	14 to 406
Soapstone,	6 to 412
Limestone,	26 to 438
Soapstone and sandstone,	5 to 443
Soapstone, 6;—and again, 8 =	14 to 457
Limestone and soapstone,	28 to 485
Soapstone,	13 to 498
Sandstone,	4 to 502
Limestone and soapstone,	10 to 512
Soapstone and sandstone,	18 to 530
Sandstone,	99 to 629
"Leather-clay,"	23 to 652
Soapstone and leather-clay,	23 to 675
Soapstone and leather-clay,	27 to 702
Sandstone containing gold,	33 to 735
Soapstone,	23 to 758
Sandstone and soapstone,	40 to 798

the present depth of the well, April, 1866, producing no petroleum.

* Mr. Ben. Long, resident superintendent, lives near the well.

Supposing the 13 foot coal bed at 261–264 to be genuine (and not a false reading of some small seams of black slate), it can only represent the Pittsburg bed, with a thickness exceeding even its fine proportions at Connellsville. The limestone (322–361) will be then in its nominal place at the top of the Barren Measures; and the bottom of the well will have descended (798–274 =) 524 feet beneath the Pittsburg bed without striking either the Elk Lick or the Upper Freeport Coalbeds; showing the Barren Measures more than 500 feet thick.

The "sandstone containing gold" (702 to 735) 33 feet thick may then be the upper member of the Mahoning Sandstone; and the sandstone and soapstone (758–798) 40 feet thick may be its lower member. Perhaps a few yards further the borer would have struck the Upper Freeport Coalbed. I have seen two small fragments of gold ore, about the size of a pea and hazelnut respectively, with a button of gold, and a certified assay of similar fragments at the U. S. Mint, giving in one case over $80.00 to the *pound* of ore. These fragments were said to have come, with many others, out of this well at the depth indicated. They consisted of cubical crystals of iron pyrites sunk in translucent quartz, over which was spread irregular plates of native gold, and in the interstices of the quartz appeared galena, not in any well-formed crystal that I could find. The ore, from whatever region it came, was evidently of extraordinary richness. The well-master reports that he went through three feet of such rock, but did not recognize its value (!) and threw the fragments, with a few exceptions, into the tip heap. Two of the owners* tell me that they collected a barrel-full of this tip-stuff and had it analyzed at the U. S. Mint for gold, and it yielded $3.00 to the ton. They say moreover that the "Cowell Well" on Meadow Run (which lies between Whitely and Dunbar Creeks), say three miles to the N. or N. W. of the Kener Well, passed through the same gold-bearing sandstone at the depth of only 550 feet. Very uncertain accounts of similar strata are reported from one or two other wells in the same district.

The ease with which an infinite variety of deceptions have been played upon well-owners, company managers, and landholders, both by wandering sharpers and respectable speculators, is of itself sufficient to condemn this whole story of the discovery of gold ore in an

* Mr. Groves and Mr. S. W. Corinth, 350 N. 2d St., Philadelphia.

oil well. Geologically speaking, it is, of course, an impossibility; certainly an incredibility. The outcrops of the Mahoning Sandstone along the Laurel Hill, Chestnut Ridge and Alleghany, Savage, Wills, Broad Top and other mountains, extend in the aggregate to thousands of miles; and the common constitution of the rock is so well known that none but an insane person would now look for a gold quartz pebble in it anywhere, even a hundred miles nearer to the gold-bearing belt of the Atlantic seaboard, much less here in the heart of the bituminous coal area. Nothing but an iceberg from the gold region of Eastern Canada could have deposited a collection of nuggets in Greene County, Penna. But we know the Mahoning sandstone was a shore deposit, filling in the bed of an exceedingly shallow and even-bottomed sea like Lake Erie, but many times larger, which had just before been created by the slow settling of the whole coal area a few yards under water-level; as is shown by the immense extent and regularity of the Upper Freeport Coalbed. In fact I think we must rather regard this water area as a marshy rolling prairie country submerged enough to receive about a hundred feet of sand and pebbles mixed with mud, irregularly but universally dropped into it, by the erosion of the tops of its own low hills or ridges, still standing out of water; in fact an immense archipelago of very soft rocks through which currents carried also material brought from afar. It even looks as if the parallel anticlinal mountains of Westmoreland and Fayette and Somerset Counties to the eastward were already raised and suffering erosion; and such was Dr. R. M. S. Jackson's opinion when he studied this part of the State under the direction of Prof. H. D. Rogers, chief of the State survey, in 1839.

It is inconceivable therefore how pieces of gold-bearing quartz, iron pyrites and galena, should find a resting-place among these submerged hummocks of coal measures; much less be deposited in a stratum three feet thick. Nor can we suppose a gold-bearing vein ascending from the floor of Lower Silurian to within five hundred feet of the surface of the top of the Middle or Barren Coal Measures; for such a phenomenon is unheard of; and if such were by any chance to be struck in one well, there would be thousands of millions to one against the repetition of the accident within a radius of three miles.

When we recall therefore the discovery of a quarter keg of ten penny nails at the depth of six hundred feet in one of the wells on Two Mile Run, Venango County, and the discovery of butter of antimony in a well in Western Virginia, we may quietly wait until

the Amber Gold Company sink their proposed shaft and report their first dividend from what they find.

To show the difference between the rough statement of so many yards of "soapstone," sandstone, limestone, "leather clay," and coal, made by common well-masters, or even between the record made out by careful treatment of bottled borings by an expert geologist, and the complete and accurately minute section which a well-trained civil engineer or mining superintendent has a chance to make during the sinking of a shaft, I will add an unpublished and important section of the air shaft of the Pennsylvania Railroad tunnel through the summit of the Alleghany Mountain, copied from Dr. Jackson's MS. notes of February 18th, 1858,

Clay, yellow, a little stony,	6.3	feet.
Slate, soft brown,	9.7 to	16.0
Sandstone, hard,	.4 to	16.4
Slate, bluish,	3.0 to	19.4
Sandstone, soft shelly,	11.4 to	30.8
Slate, black,	16.5 to	47.3
Sandstone, coarse, much sulphur in first inch,	1.7 to	49.0
Slate, black, with frequent S.S. strata,	20.8 to	69.8
Sandstone,	2.0 to	71.8
Slate, black,	.5 to	72.3
Coal,	.5 to	72,8
Fireclay, hard at top, soft at bottom,	11.5 to	84.3
Slate, hard, blackish,	5.0 to	89.3
Sandstone,	2.0 to	91.3
Fireclay,	9.7 to	101.0
Slate, hard,	11.8 to	112.8
Sandstone, hard,	4.0 to	116.8
Slate, black, hard,	16.4 to	133.2
Sandstone, solid,	1.0 to	134.2
Slate, black, rocky,	4.0 to	138.2
Fireclay,	7.6 to	145.8
Slate, bluish, hard,	19.4 to	165.2
Sandstone, hard,	2.0 to	167.2
Slate, black, hard, micaceous,	7.6 to	174.8
Slate, blue,	1.0 to	175.8
Slate, black, one inch at bottom soft,	5.7 to	181.5
Coal, bituminous,	5.0 to	186.5
Fireclay,	.5 to	187.0

Sandstone, brown, hard, with sulphur,	3.0 to 190.0
Slate, shelly,	1.0 to 191.0
LIMESTONE, rotten,	1.5 to 192.5
Sandstone,	1.0 to 193.5
Slate, shelly,	6.0 to 199.5
COAL,	1.0 to 200.5
Fireclay, hard,	1.0 to 201.5
Fireclay, calcareous,	1.5 to 203.0
LIMESTONE rock,	2.0 to 205.0
Fireclay, hard,	2.0 to 207.0
LIMESTONE,	1.0 to 208.0
Fireclay,	1.0 to 209.0
LIMESTONE and small seams of F. C.,	3.5 to 212.5
Slate, decomposing in air,	2.0 to 214.5
LIMESTONE,	1.0 to 215.5
Fireclay,	2.5 to 218.0
LIMESTONE,	.5 to 218.5
Slate and fireclay,	11.0 to 229.5

which cannot be many feet above the Great Bed cut by the tunnel in its upward grade of 1° westward, the bed itself descending with a dip of 1° westward. The above 229.5 therefore represents the middle portion of the Lower Coal Measures. The entire absence of workable coal beds above the tunnel bed is due to the fact, that the top of the section is not high enough to take in the Freeport Series, which underlie the Mahoning Sandstone.

Pleasant Unity is a village nine miles south-southwest from Latrobe, on Sewickley Creek. West-northwest of this village two and a half miles is Pauf Graff's oil well, begun October, 1864, which commences 50 feet beneath the Pittsburg Coal-bed, and reached a depth of 550 feet in May, 1865, in a mass of sandrock. It reported "shows of oil at 450, 510, and 550; and pumped at each, getting several gallons."

Three hundred yards due north of this well, is the Old Oneida Salt Well, bored in 1840, 800 feet deep, a tradition being in existence that it flowed a hundred barrels of oil per day. On the strength of this tradition it was reamed out in 1858, with no result beyond passing a show of oil at 538 feet, and after that coming (at a depth not stated) to a coal-bed from 12 to 14 feet thick; which, if not fabulous, must be an exaggerated estimate of the Upper Freeport Coal-bed, the outcrop of which is not three miles away, at the foot of the Chestnut Ridge. It is probably the 7 feet coal-bed of the following section, and a good illustration of the unreliability of the thickness

of coal-beds in oil well records. The interesting point of this section is the limitation of the Barren Measures to about 50 + 538 + ? = say 600 feet.

The following is a record of 844 feet of St. Mary's Well, on Sewickley Creek, about a mile from Chestnut Ridge, in Mt. Pleasant Township, Westmoreland County, Pennsylvania, furnished by Mr. S. S. Jack, of Pleasant Unity.

Mouth of well, geologically, about 50 feet below Pittsburg Coal-bed; and a quarter mile east of its outcrop.

Slate rock,	40 feet.
Reddish rock,	12 to 52
Soapstone,	10 to 62
Hard rock,	12 to 74
Soft rock (water crevice at 86 feet),	12 to 86
Reddish rock,	14 to 100
Hard blue rock,	70 to 170
Block slate or shale; (1st oil-show at 184),	14 to 184
First sand rock, hard, white,	96 to 280
(Very large water vein at 280.)	
Gray rock (2d oil show and gas at 427),	147 to 427
Black rock,	46 to 473
Limestone,	70 to 543
Second sand rock,	15 to 558
Horseback,	7 to 565
Coal-bed [Elk Lick coal?],	7 to 572
Third sand rock, white,	30 to 602
Hard gray rock [Mahoning S. S.?],	65 to 667
Coal-bed [Upper Freeport?],	2 to 669
Fourth sand rock, white,	30 to 699
Dark rock,	16 to 715
Soapstone,	16 to 731
Fifth sand rock, white,	24 to 755
Limestone [Freeport],	23 to 778
(Salt water crevice at 778, gas very strong.)	
Sand rock, very hard,	66 to 844

The rest of the record of this well is not at present obtainable. Mr. Jack was good enough to forward 14 samples of both rock and coal; adding: "We expected to find a small bed of coal within the first hundred feet; but it was not noticed; although found in a well bored a short distance, say 70 rods, southwest; and also in gigging

for water 14 feet under the surface, at a point a quarter of a mile to the south."

There is always at least one small bed of coal near the top of the Barren Measures, under the Pittsburg bed.

"There is a great flow of water and gas from the well, the gas acting periodically with force sufficient to eject the water from the mouth of the tubing (laid horizontally 6 feet from the ground) to a distance of 50 feet." The strong dip from the anticlinal of the Chestnut Ridge makes all the wells along its western foot artesian. "This well has never been properly tested for salt or oil, because the fresh water has never been exhausted."

The following is the record of Governor Johnson's oil well, bored in the centre of the gorge of the Loyalhanna River through Chestnut Ridge, about six miles east of Latrobe. The mountain rises 800 or 900 feet above the bed of the river, and is capped with the bottom coal measures. The well commences at a point about thirty rods up stream from where the axis of the great anticlinal of the Ridge crosses the river. It is therefore nearly on the crown of the arch. White and red sandrocks belonging to the Upper Devonian system (IX and X) form crags overhanging the river banks.

"Soil,"		14 feet.
Slate, blue, to a vein of fresh water,		25 to 39
"Bluestone,"		25 to 64
Soapstone,		4 to 68
Bluestone,		10 to 78
Sandstone,	white to salt water vein,	24 to 102
	gray to where "tools dropped, ten inches,"	22 to 124
	"black,"	30 to 154
small show of gas, borings of black slate, perhaps coal; water-vein white as milk.		
Black slate, pretty soft,		60 to 214
"Bastard blue stone,"		26 to 240
Sandstone,	white to a grand spring of fresh sulphur water,	74 to 314
	pebble rock,	2 to 316
	quartz rock,	45 to 361
	white,	43 to 404
Black slate,		*18 to 422
Sandstone; to a vein of gas,		10 to 432

* Omitted, and perhaps justly, in S. M. Wickersham's letter, No. 124 First St., Pittsburg, June 14th, 1865.

Soapstone,		75 to 507
Blue slate,		35 to 542
Blue stone,		15 to 557
Gray stone,		35 to 592
Brown, very hard, red in centre, the rest blue,		43 to 635
Sandstone,	red; with blue stone; salty,	*68 to 703
	gray,	10 to 713
	red; with blue stone,	20 to 733
	blue; salty,	22 to 755

the depth of the well July 20th, 1865, when the manager wrote, "We have lots of gas and soot, and the rock is very oily and salty."

Record of Borings on the Clarion Coal and Oil Company's tract, Wilcox, Elk County, Pa., sunk by Adams & Babcock, communicated by Mr. O. N. Adams. The well is situated on West Branch of Clarion (West Toby), on Warrant No. 2676, near and inside of the south line of McKean County, Pennsylvania.

"Coal crops out about 370 feet above well mouth, in the surrounding hills."

Conducting pipe through gravel,		41 feet.
Slate; (at 60 feet from surface heavy water-course,)		30 to 71
Shale; red,		137 to 208
Sandstone; blue,		8 to 216
Slate; Shale; red,	"These red shales are hard and compact like sandstone."	26 to 242
		64 to 306
Sandstone; micaceous,		21 to 327
Sandstone; blue,		5 to 332
Shale; *red*,		31 to 363
Slate,		13 to 376
Sand; blue,		8 to 384
Shales; *red* (salt water),		31 to 415
Sandstone; blue,		14 to 429
Slate,		85 to 514
Sandstone; micaceous,	("mica and iron pyrites abundant,")	47 to 561
Slate, ("often called black sand,")		77 to 638
Sandstone; blue,		20 to 658
Slate,		43 to 701
Sandstone; micaceous,	(gas and black soot abundant for 100 feet downward,)	48 to 749

* 100 feet in S. W. Wickersham's letter of July 22d, 1865.

Shales; olive,	65 to	814
Sandstone; micaceous,	21 to	835
Shales; olive; very soft; "putty rock,"	11 to	846
Sandstone; micaceous,	18 to	864
Shales; olive,	7 to	871
Sandstone; micaceous,	5 to	876
Shales; olive,	5 to	881
Sandstone; micaceous; chocolate hue,	9 to	890
Shales; olive; black gas from here downward,	23 to	913
Sandstone; micaceous,	6 to	919
Shales; olive, { six inches of sandrock interposed between 6 and 6, }	6 to	925
Shales; *red*, { six inches of sandrock interposed between 6 and 6, }	6 to	931
Sandstone; micaceous; very hard; olive,	5 to	936
Shales; olive,	2 to	938
Sandstone; micaceous; silicious; hard; compact,	10 to	948
Shales; olive,	6 to	954
Shales; *red* and olive,	2 to	956
Shales; olive,	38 to	994
Sandstone; gray; light; very hard; iron pyrites,	3 to	997
Shales; very soft, { a few inches of hard sand rock interposed between these. }	6 to	1003
Clay; blue, { a few inches of hard sand rock interposed between these. }	6 to	1009
Shale; olive; more compact; 3 divides,	65 to	1074
Sandstones; micaceous; dark soft, { (strong smell in derrick lifting tools,) }	36 to	1110
Soapstone or mud vein,	2 to	1112
Sandstone; gray; very hard,		1114
Sandstone; light gray; very hard,		1116
Sandrock; bottom very hard and very fine,	28 to	1140
Slate rock; very hard with quartz intermixed,	25 to	1165
Sandstone; very hard; fine; soft in streaks; at 1172 feet occurs mud and soft spot 4 inches; here a gas vein spouted five times twenty feet high; and again, but not so strong, at 1202 feet, March 27th,	36 to	1201
Sandstone; very hard; fine; soft in streaks,	26 to	1227
Slate rock with scales of hard sand,	10 to	1237
Slate rock; gas in sand-pump,	11 to	1248
Sandstone hard, and slate soft; black soot and smell on tools, April 6th,	21 to	1269
Slate with sand; red and white; very small pebbles, April 13th,	25 to	1294
Slates with sand,	8 to	1302

Record of No. 2 well on Hyner Run, half a mile above its junction with Pithole Creek, Venango County, Pa., furnished through the kindness of General Tyndall, of Philadelphia.

Length of conductor to solid rock,	9 feet.
Soapstone,	
Sandrock, hard white; layers of gray; large water-course,	71 to 80
Slate,	48 to 128
Sandrock ("2d"), about	4 to 132
Slate,	68 to 200
Sandrock; about	5 to 205
Soft slate,	4 to 209
Sandrock; hard and then with	6 to 215
Hard and soft streaks,	24 to 239
Slate,	220 to 459
White sandrock,	31 to 490
Slate,	50 to 540
Sandrock ("4th"),	16 to 556
Crevice, "with a very good show of oil and gas,"	2 to 558
Sandrock,	3 to 561
Slate,	39 to 600
Reddish slate in thin layers and hard sand rock gradually becoming soft with a fine show of oil and some gas,	12 to 612
Slate; hard to the bottom,	22 to 634

The well at this depth pumped 50 to 75 barrels of oil per day for some months.

Record of the Old United States Well (Frazier Well) on Pithole, Venango County, Pa.

Slates; variegated,	95 feet.
1st Sandrock,	40 to 135
Slates; variegated,	215 to 350
2d Sandrock,	30 to 380
Slates; variegated,	85 to 465
3d Sandrock,	20 to 485
Slates; variegated,	110 to 595
4th Sandrock; to bottom,	12 to 607

This well is said to have yielded originally 800 barrels, and now to yield from 20 to 100 barrels per day, according to different authorities.

The record of No. 47, or Burchell Well, which is said to flow 150 to 200 barrels per day, does not vary over two or three feet in the

tops and bottoms of its sandrocks, from the record of the Frazier Well, given above.

Record of Glade Well, or Well No. 7, Sugar Camp branch of Stewart's Run (half mile up the branch), two miles from Alleghany River, and about the same distance east of Pithole. Stewart's Run is in the next valley east of Pithole, descending southward to the River, Venango County, Pa.

Slate and crevice of water,	50 feet.
Slate (common),	20 to 70
Sandstone; hard, and gas,	5 to 75
Slate,	20 to 95
Sandstone and gas,	2 to 97
Soapstone,	21 to 118
Soft clay slate,	78 to 196
Red slate,	50 to 246
Soapstone slate,	20 to 266
Red slate and water crevice,	21 to 287
Red slate,	31 to 318
Sandstone; white, and gas,	37 to 355
Slate,	40 to 395
Sandstone and slate,	12 to 407
Sandstone; hard, and gas,	25 to 432
Slate; mud vein,	20 to 452
Slate and sandstone,	15 to 467
Sandstone; hard; white,	10 to 477
Sandstone; gray, and gas,	10 to 487
Slate (common),	53 to 540
Sandrock; coarse,	4 to 544
Soapstone and water crevice,	20 to 564
Sandstone; gray,	8 to 572
Slate,	10 to 582
Flintrock,	2 to 584
Sandstone with crevices,	4 to 588
Slate,	10 to 598
Sandstone,	2 to 600
Slate,	12 to 612
Sandstone and red slate,	4 to 616
Slate; to bottom,	15 to 631

Actual depth of well when abandoned 610 feet, the discrepancy being left unexplained.

Mr. Lea exhibited specimens of Eozoon Canadense, received from Mr. Billings, of Montreal, in rough, polished and dissected states. A discussion ensued, in which Prof. Hayden, Dr. Le Conte, Mr. Barnes, Judge Hare, and Mr. Lesley took part.

Pending nominations Nos. 541, 547, 548, 549, were read and balloted for, and there being no further business, the presiding officer announced the following persons duly elected members of the Society.

Dr. Pliny Earle, of Northampton, Massachusetts.

Dr. Owen Jones Wister, of Germantown, Pennsylvania.

Mr. Thomas Davidson, of Brighton, England.

Dr. Fridolin Sandberger, of Wurtzburg, Bavaria.

And the Society was adjourned.

Stated Meeting, May 4, 1866.

Present, sixteen members.

Vice-President Prof. CRESSON, in the Chair.

A letter accepting membership was received from Dr. O. J. Wister, dated Germantown, April 25th.

A letter from Mr. J. R. Snowden, Secretary of the Historical Society of Pennsylvania, requesting facilities for Mr. Edw. Armstrong to examine sources of information on the subject of the life of the late Mr. Duponceau, was read, and on motion of Dr. Wood the request was granted.

A letter respecting the publication of a treatise upon the laws of the French Language was received from Prof. E. Taliaferro, dated College of William and Mary, Williamsburg, Va., April 25th.

A photograph of Prof. S. S. Haldeman was presented by Dr. Le Conte, for the Album.

Donations for the Library were received from Sig. Lombardini, Dr. Schinz, the Bureau of Mines, the Royal Astronomical Society, the Rhode Island Society for the Encouragement of Domestic Industry, Dr. B. A. Gould, Prof. W. A. Norton,

Dr. Wirtz, of New York, Hon. W. D. Kelley, the Medical News, and the Young Men's Association of Buffalo.

Mr. Peale exhibited specimens of Indian pottery of the stone age, recently obtained near the Little Falls of the Potomac, and presented a photographic picture of them grouped.

The use of steatite or soapstone, clinochlore, a variety of serpentine, and of magnesian rocks, among the aborigines, during the stone age in this country, is demonstrated by the numerous fragments of vases, pots or mortars, found in many places frequented by them, but it is rare that perfect or unbroken vessels of this kind are left to us, as evidence of the status in civilization of these primitive people. The reason of this rarity may be found in the fragile character of the mineral, and their entire abandonment the moment an iron or brass vessel comes into possession. It is therefore with great satisfaction that I submit to the inspection of the members the examples before you.

The smallest of the two is analogous in material to the soapstone of the old quarry on the Schuylkill near Manayunk, but its origin is unknown to me, further than that it was contributed to the Great Central Fair, from whose sales it came into my possession by purchase.

The large vessel, made of a kind of greenstone trap as it appears, is of the usual oval form, thirteen and a half inches long, nine wide, and four and a half deep inside, and is capable of containing a half gallon of liquid, with sufficient margin left for ebullition. Other specimens which have been saved to us in imperfect condition are generally of the same form, and make it evident that the specimens before the Society, conform to and constitute the type of these vessels generally.

The steatite of which many vessels were made was doubtless selected principally on account of the ease with which it could be worked, by the use of flakes of jasper or hornstone, and retain marks of the employment of such materials both in the interior and on the exterior of their surfaces; it is true, that it is a poor conductor of heat, but it is equally so, that after being heated it would retain an elevated temperature a long time.

The projections at the ends were undoubtedly made for convenience in handling, and it may be to support the vase when placed on blocks or stones over a fire, for which purpose also, holes were sometimes perforated near the edge or rim, through which holes strips of skin,

or filaments of other materials, were passed in order to suspend the vessels. Several fragments in my collection are thus perforated.

In the more carefully worked articles, these projections are neatly and symmetrically formed, as shown by the smaller fragment, which is one of these projections. It appears to be evident that generally these vessels were left rough from the stone tools with which they were made, but in some instances they were smoothed to an extent nearly meriting the term polished, of which the fragment under consideration is an example.

The larger fragment also exhibits the above noticed projection, and the curved, oval form, alluded to in a preceding part of this communication, and was made of a magnesian rock, somewhat resembling steatite; through it is disseminated a considerable amount of sulphuret of iron.

It is probable that the large vase was used not alone as a cooking vessel, but served a double purpose by the aid of a pestle, for crushing or pulverizing food, a conclusion justified by the smooth or worn appearance of the bottom of the cavity, and still further by the tradition, that the pestle herewith exhibited was found within the vase.

This vessel was found on the farm of Mr. Robert H. Donaldson, near the Little Falls of the Potomac in Virginia, in whose possession it has remained for many years, serving the purpose of a receptacle for the food of his poultry, not in this instance to be considered a degradation, as it has saved it from destruction, the usual fate of such articles when not protected by the intelligence or better feeling of those in whose hands they remain after the Race which made them has departed. For this specimen we are indebted to the laudable good sense of the above-named gentleman.

A discussion of the subject ensued in which Dr. Le Conte expressed his opinion that the mere presence of metal was non-essential where the metal was used as a natural product precisely as stone had been used, and without any metallurgical skill; as in the case of the iron arrow heads now used, indiscriminately with obsidian arrow heads by the savages of California, the iron being merely fragments of tire iron found abandoned by the emigrants upon the plains; or as in the case of the meteoric iron used by the Esquimaux.

The Committee of Finance reported that the claim of the Society for certain coal lands in Northumberland County has been compromised and settled. One thousand dollars (less

fees) has been paid into the treasury, and the remaining three thousand dollars has been properly secured.

The Committee of Conference appointed to confer with a committee of the Academy of Natural Sciences of Philadelphia, was on motion discharged from further consideration of the subject, inasmuch as the committee of the Academy had been previously discharged.

On motion of Dr. Le Conte the Secretaries were authorized to procure a suitable album for preserving the photographs of the members.

And the Society was adjourned.

Stated Meeting, May 18, 1866.

Present, sixteen members.

Prof. CRESSON, Vice-President, in the Chair.

A letter accepting membership was received from Dr. Pliny Earle, dated Northampton, May 5th, 1866.

Letters of invoice were received from the Holland Society at Haarlem, and Prof. J. D. Whitney, San Francisco, April 16th, 1866.

Photographs of Thomas U. Walter, Dr. John Morgan, and Mr. Robert Briggs, were presented for insertion in the Album. The photograph of Dr. Morgan was from J. R. Lambden's copy of a portrait by Angelica Kauffmann.

Donations for the Library were received from the Geographical Societies at St. Petersburg and Paris, the Academy at Berlin, Prof. Zantedeschi, the Observatory of San Fernando, the Society of Sciences at Haarlem, the Boston Natural History Society, the Editors of the American Journal of Science, the Franklin Institute, Smithsonian Institution, Prof. J. C. Cresson, Prof. J. D. Whitney, and various booksellers.

A communication was offered for publication in the Transactions, entitled "On Fucoids in the Coal," by Leo Lesque-

reux, which was referred to a committee consisting of Mr. Lea, Mr. T. P. James, and Mr. Lesley.

A communication was offered for publication in the Transactions, entitled "The Law in the Forms of Continents and Oceans," by O. Reichenbach, which on motion was referred to a committee consisting of Prof. Cresson, Prof. Kendall, and Prof. Hayden.

The Secretary then read a communication entitled: "Observations upon some species of *Spirifera*, being the concluding remarks of the chapter on the descriptions of species of that genus from the upper Helderberg, Hamilton and Chemung groups." (From the Palæontology of New York, vol. iv, pp. 252–257; unpublished.) By James Hall.

Some important considerations are suggested by the study of *Spirifera prœmatura*, *Spirifera alta*, and their associates.

The species which I have here designated as *Spirifera prœmatura* presents no external markings which enable one to say that it is distinct from *S. hirtus* of the sandstones at Burlington, Iowa; nor does it present differences from *S. pseudolineata* which may not be reconciled with geographical influences, and with a habitat nearer to the shore line and the essential absence of calcareous matter in the sediments deposited. Its associates, however, are of different species from those in the western locality; but still among the more conspicuous of these is *Spirifera alta*, *Productus lachrymosa* var., and *Chonetes muricata*, which have a carboniferous aspect; and were it not for the presence of *Spirifera disjuncta* and one or two others, the general aspect of the fauna might be termed carboniferous.

If again we look at the characters of *Spirifera alta*, an analogue or representative of *Spirifera cuspidata*, we have many points of similarity with one or more species in the rocks of the West and Southwest which are usually referred to a higher position. The high area and the transverse concave septum, which is not a true pseudodeltidium, allies it with *Spirifera textus*, in which we find similar features. In the *S. alta* there has probably been an external convex pseudo-deltidium, and between this and the septum closing the fissure there has been a narrow space. This septum, which is an extension of the dental lamellæ, has been thickened or expanded on the inner side, as shown by the casts of the ventral valve; and in several specimens there is a narrow semi-cylindrical depression extending nearly to the beak of the valve.

In comparing this species with *Spirifera textus*, we find similar conditions, or more properly an extension or amplification of the same features. In that species there is a convex arching pseudo-deltidium, though rarely preserved in the specimens. Beneath this there is a concave septum, and upon the inner face of this there is a tubular callosity; or, in other words, the inner laminæ of the septum become fistulous, and inclose a cylindrical or subcylindrical space, which extends from the base of the septum to near the apex of the valve.* But more usually the laminæ appear to be separated, and extending inwards are recurved, their edges sometimes joining to form a tube, but more frequently perhaps the margin of each one is recurved upon itself, leaving the tube with a slit along the lower side. In some instances, however, these extensions from the inner face of the septum continue to the bottom of the cavity, and joining the external shell leave a quadrangular tube instead of a cylindrical one.

It is evident from what has been said, as well as from the illustrations given, that there is a near approach to this character of *S. textus*, or an incipient step towards it, in *Spirifera alta;* but the type has not become fully developed. We have the concave septum with a semicylindrical callosity on its inner face, but this ridge has apparently remained solid. The concave septum, however, must not be confounded with the pseudo-deltidium: the latter is apparently an independent growth of shelly (or sometimes perhaps scarcely solid shell) matter, forming an exterior plate from the apex of the fissure, covering to a greater or less extent the opening; but apparently not connected with, nor a part of the dental lamellæ or substance of the area, while the septum is an outgrowth or lateral extension of the dental plates.

In the case of *Spirifera alta*, the extension of the septum is so great, that when connected with the general form of the shell, its nearest analogue appears to be *Spirifera textus;* which, so far as I can now determine, is identical with the one described as *S. subcuspidatus* in the Geological Report of Iowa. The latter is a carboniferous species from the Keokuk limestone, and closely allied to the *Spirifera cuspidatus* of Europe; and the Chemung species thus reminds us of the Carboniferous one, or has a carboniferous aspect.

If, in its full development, the presence of a septum and internal tube be regarded as of generic value, then we have in *Spirifera alta*

* It is upon this feature, or one of similar character, in its full development, that I understand Prof. Winchell proposes to found the Genus Syringothyris.

the same appendages in part, or in a partially developed condition; the distinct tube only being wanting. But had we the means of examining the internal characters of the ventral valves of all the species of Spirifers, we should probably find graduations from the solid filling of the rostral cavity, with a greater or less extension of shelly matter in the form of a septum in the fissure occupying a narrow space in its apex, till we reach the development observed in *S. alta* and *S. textus*.

To a considerable extent, we are able to prove this supposition. In the separated valves of *Spirifera radiata* of the Clinton and Niagara groups, there is a filling of the rostral cavity, and a thickening of the dental lamellæ which are extended for half the length of the valve. The narrow median crest of the muscular impression is expanded and thickened towards the apex of the valve, but there is no evidence of a septum. In *Spirifera niagarensis* there is a filling of the rostral cavity and a thickening of the dental lamellæ, which are distinctly separate; but no appearance of a septum: there is a low median crest in the muscular impression.

In the Lower Helderberg group, the *Spirifera macropleura* has the rostral cavity filled to a greater or less extent, and the dental plates extremely thickened at their bases; while there is an obscure low median crest in the muscular impression, which sometimes becomes thickened and expanded above; and occasionally there is a little filling of the upper part of the fissure, resembling the incipient stages of growth of the septum. In *Spirifera cycloptera* the rostral cavity is more or less filled and solid, with diverging dental lamellæ; while the crest dividing the muscular impression is very unequally developed, and there is no appearance of a septum. In *Spirifera perlamellosa* the rostral cavity is filled to a greater or less degree, the dental lamellæ are short and strong, and there is a sharp elevated median crest or septum in the muscular impression; but there is no indication of the transverse septum. In *Spirifera octocostata* the dental lamellæ are thickened, and there is a *vertical* septum reaching from the apex of the rostral cavity to the base of the muscular impression. In *Spirifera marylandica* of the Oriskany sandstone, there is sometimes a partial filling of the rostral cavity, with a reversed conical crest in the upper part of the muscular area. *Spirifera arenosa* has strong dental lamellæ; a filling of the rostral cavity in old shells; a low crest, dividing the muscular impression, which becomes thickened in its upper part; a distinct pseudo-deltidial covering of the fissure, but no transverse septum.

Among the Spirifers of the Upper Helderberg group, *Spirifera acuminata* has usually only a moderate thickening of the rostral portions, divergent lamellæ of moderate strength, and no transverse septum. In *Spirifera oweni* the rostral cavity is partially filled; the dental lamellæ are thickened; there is a reversed conical callosity at the apex of the cavity, the attenuated continuation of which divides the muscular area: the fissure is closed by a thickened plate or septum for one-half its length from the apex. In *Spirifera raricosta* the rostral cavity is filled; the dental lamellæ are short and thick; the fissure is closed by a solid filling for a part of its length, while from the bottom of the cavity there rises a thin vertical septum which extends to within one-third the length of the front of the valve. In *Spirifera gregaria* the rostral cavity is more or less filled with thickened dental lamellæ, and sometimes the incipient growth of a transverse septum is perceptible.

In several of the Spirifers of the Hamilton group the septum is well marked, while in others there is an incipient development of the same character. In *Spirifera granulifera* the upper part of the rostral cavity is filled with shelly matter, and this apparently encroaches upon the space below with the advancing age of the shell. The fissure becomes partially filled, and a thickened plate projects a little in advance of the solid filling of the beak, leaving behind it, or on the inner side, a conical cavity directed towards the apex of the shell. The muscular area is divided by a low longitudinal crest, which, in its extension towards the beak, becomes wider, and is often much thickened towards its junction with the solid shelly matter filling the rostral cavity. Looking at this feature from the apex of the shell, it presents a subconical form, and is more or less abruptly attenuated towards the centre of the muscular impression. This callosity sometimes becomes so prominent as to produce an emargination or indentation in the apex of the cast, and a similar feature is often observed in the casts of other species of SPIRIFERA.

Regarding the *S. granulifera* alone, there is little to attract especial notice, beyond the general fact of a partial filling of the rostral cavity with the exterior portion prolonged between the dental lamellæ, but so much thickened as scarcely to merit the term septum. In *Spirifera marcyi* this development of shelly matter has the character of a true septum, closing one-third or more of the length of the fissure from above, and leaving an open rostral cavity behind it. In *Spirifera medialis* and *S. macronotus* there is a thickened transverse

septum extending from one-third to one-half the length of the fissure from the apex, and this feature is quite independent of the pseudodeltidium. The rostral cavity lies behind this septum, and may be open or free from the accumulation of shelly matter to a greater or less extent; but it is not uncommon to find nothing more than a thickening of the base of the dental plates and a partial filling of the rostral cavity. This condition changes to a greater or less extent during the growth of the shell; but a partial filling of the fissure at its apex is probably more common than otherwise, particularly in full-grown individuals.

In the Spirifers of the Carboniferous rocks which I have been able to examine, this feature is variably developed. In *S. plena* of the Burlington limestone, the septum extends for more than half the length of the fissure; while it is less developed in *S. grimesi*, and scarcely at all in *S. increbescens* and *S. opima*.

The shell texture of SPIRIFERA is usually regarded as fibrous, and this is true of all those I have examined, though in some of the species of the higher formations I have observed characters which, with imperfect means of investigation, seem to be irregularly distributed ducts penetrating the shell. I have not been able to examine the shell of *Spirifera alta*, to learn whether any changes have taken place in its texture, not observed in other species of SPIRIFERA; but in *S. textus*,* where the septum and tube are developed, the shell is penetrated by numerous pores or ducts which are somewhat coarser than the ordinary punctate structure of some other Brachiopoda; and though not in actual contact, are often arranged in regular order and frequently in close proximity to each other, not essentially differing from that of SPIRIFERINA as given by Dr. CARPENTER. The intermediate spaces have a distinctly and beautifully fibrous or prismatic structure, differing in no respect from ordinary Spirifers or ATHYRIS.

It should be observed, in this connection, that the dental plates, both in *Spirifera alta* and *S. textus*, reach to the bottom of the cavity, and partially surround the muscular impression, which is precisely like that of ordinary Spirifers.

* In this species and in *Spiriferina spinosa* of Norwood & Pratten, the pores or ducts are unequally distributed; being, in some parts of the shell, closely crowded, while in others they are more distant and often following the line of growth, though frequently irregularly disposed.

Prof. Winchell remarks, of the proposed Genus Syringothyris, that "the shell is impunctate in all conditions and under high powers."

In these remarks, I have not intended to express an opinion of the generic value of certain characters, but merely to show, as it appears to me, a gradual or successive development in certain parts, which finally becomes so wide a departure from the characters of typical forms of SPIRIFERA, that it deserves especial attention. Nor can we deny that this progressive development of the septum and its modifications keeps pace and corresponds with the geological succession; reaching its extreme state, so far as now known, in the Carboniferous period.

In our investigations of the Chemung group in its more easterly extension in the State of New York, it has proved, throughout the greater part of its thickness, to be comparatively barren of animal organisms, though often containing an abundance of the remains of land vegetation. As we progress westerly, the coarser sediments have given place to finer materials, or are more or less intercalated with shales or shaly and calcareous beds, while the coarser beds exhibit less resemblance to shore deposits, and we find an increasing number of animal remains both of the Brachiopoda and Lamellibranchiata, though there are usually few of any other class. But these are not equally distributed, either vertically or horizontally.

There is one fact, however, which can scarcely fail to impress the collector of fossils in this group of strata, which is, that in going westward, certain forms which are abundant in some localities become rare or disappear altogether, so that sometimes localities not very far removed from each other give almost entirely a different set of species. Certain species which are common in Schoharie, Broome, Tioga and Chemung Counties, I have not seen in Cattaraugus and Chautauque Counties; while many species which are common in the western counties are quite rare or unknown to me in Tioga, Tompkins, and the counties east of these. Although we may attribute this view in some part to our imperfect collections, it is nevertheless in a great degree true.

Reasoning upon the nature and origin of the sediments as well as upon these observed conditions, we might expect to find a changing fauna as we recede from the ancient coast line furnishing these materials, and which were then swept into the wide ocean to the westward. While in some of the more eastern localities we find species of the Hamilton group apparently mingling with those of the Chemung group, the higher beds of Cattaraugus and Chautauque Counties give us an association of fossils having a more carboniferous

aspect than those of the higher beds in the eastern counties of the State.

Besides the contemporaneity of the sedimentary formations holding dissimilar species in distant localities, we have to regard the gradual lithological changes affecting the character of the fauna in the same continuous deposition. There can be no longer any question that the higher arenaceous and argillaceous formations of New York and the adjacent portions of Pennsylvania, when traced in a southwesterly direction, become intercalated with calcareous bands, gradually giving out and becoming replaced in a great degree by calcareous or argillo-calcareous deposits in which some of the same species of fossils continue, while there is an accession of other forms adapted to the changed conditions of life.* In the extreme southwestern extension of the Palæozoic series the interval between the Upper Helderberg group and the coal measures, which in the north is occupied by the Hamilton, Portage, Chemung, and Catskill formations, which constitute so marked a feature in New York, Pennsylvania, and Ohio, is there filled almost exclusively by calcareous accumulations, but we can scarcely suppose that the lapse of time required for the deposition of the northern sedimentary formations remained unrecorded by a fauna of some kind while the interval is filled by an accumulation of a thousand or more feet of calcareous formation.

It here becomes a matter of great interest to decide what shall constitute the *fauna Devonian*, and what may be regarded as the *fauna Carboniferous*. Looking at the great number of Productus (for although I have used the term Productella as indicating certain distinctions, the fossils are in all essential respects Productus) in the central and western portions of the State, they alone would give a Carboniferous aspect to the fauna. But when we find *Spirifera disjuncta*, and other fossils of acknowledged Devonian age, we instinctively allow less than the due importance to the Carboniferous evidence. Nevertheless we are forced to admit, even within the State of New York, a gradual diminution of the Devonian types, and an augmentation of the Carboniferous types, in the same beds as we go westward. And finally, we have every reason to believe that in those

* I have already shown a similar condition existing at the period of the coal measures, where some calcareous bands of a few feet in thickness in Ohio, Pennsylvania, and Virginia, become expanded, so that together with the associated calcareous shales they embrace almost the entire formation towards the Rocky Mountains and Mexico in the far western and southwestern regions of the United States.

sedimentary formations, between the Hamilton group and the Coal measures in the east, and between the same group and the Burlington (Carboniferous) limestone in the west, the Devonian aspect of the fauna on the one hand, and its Carboniferous aspect on the other, are due in a great degree to geographical and physical conditions, and not to difference in age or chronological sequence of the beds containing the fossils.

This view of the case, which is consonant with the facts observed, will account for the coming in of forms which we term Carboniferous, as we pursue our investigations to the westward.

The same opinions seem gradually to be obtaining ground in Great Britain, but the idea is not new with me. It is now about fifteen years since I expressed similar opinions in a review and comparison of the Palæozoic groups and systems of Europe and America.*

In some of the concluding paragraphs of this chapter, after having made a comparison of the species cited as common to the Silurian and Devonian and to the latter and the Carboniferous system, I have said:

"The arenaceous and argillaceous deposits, which we trace uninterruptedly over so wide an area, and which present to us such gradual and almost imperceptible changes in the fauna when studied continuously, would, if broken up and isolated so that they could not be traced consecutively, present the same phases which are exhibited by the systems in Europe to which they are related. From all these facts there seems to be but one conclusion, and that is, in the British Islands particularly, either there are remarkable exceptions to the general law in the continuation of species from one to another, or that there is no foundation for a distinction between the Devonian and Carboniferous systems."

Note.—The *Spirifera alta* referred to in the preceding pages is an analogue of the European carboniferous *Spirifera cuspidata*, having a similar elevated area which is usually "slightly inclining forward or nearly rectangular to the general plane of the dorsal valve. The fissure is high and narrow, and is closed for two-thirds of its length from the apex by a concave septum which is entirely independent of the pseudo-deltidium." On page 249 of vol. iv, Pal. N. Y., I have made the following remarks under the description of the species:

* In Foster and Whitney's Report, chap. xxiii, pp. 285–318.

"This species is known to me only in the condition of casts of the interior, and its usual appearance is illustrated in the figures on Plate xliii. Its general aspect is much like that of the European *Spirifera cuspidata*, Martin; but there are important differences by which it may be distinguished: these are, the plications on the mesial fold, the larger area of the dorsal valve, and the shorter extension and greater divergence of the dental lamellæ by the sides of the muscular impression. Some of these characters, I conceive, are not likely to change to those shown by *S. cuspidata*. In the concave septum closing two-thirds of the fissure from above, it resembles that species as described by Prof. McCoy, who mentions the presence of a 'deep-seated pseudo-deltidium.'* In one of the figures given by Mr. Davidson and referred with doubt to this species,† the cast shows a tubular perforation in the filling of the fissure; and a gutta percha impression from the same shows the mark of a foramen, but there is no positive evidence of a septum, which is so conspicuous in our specimens, and which I suppose to be the feature characterized by Prof. McCoy as a deep-seated pseudo-deltidium. In our species I have not been able to discover any corresponding perforation; the only indication of this being the semi-cylindrical impression along the centre of the fissure (in the cast), showing a callosity of the septum behind the exterior wall.

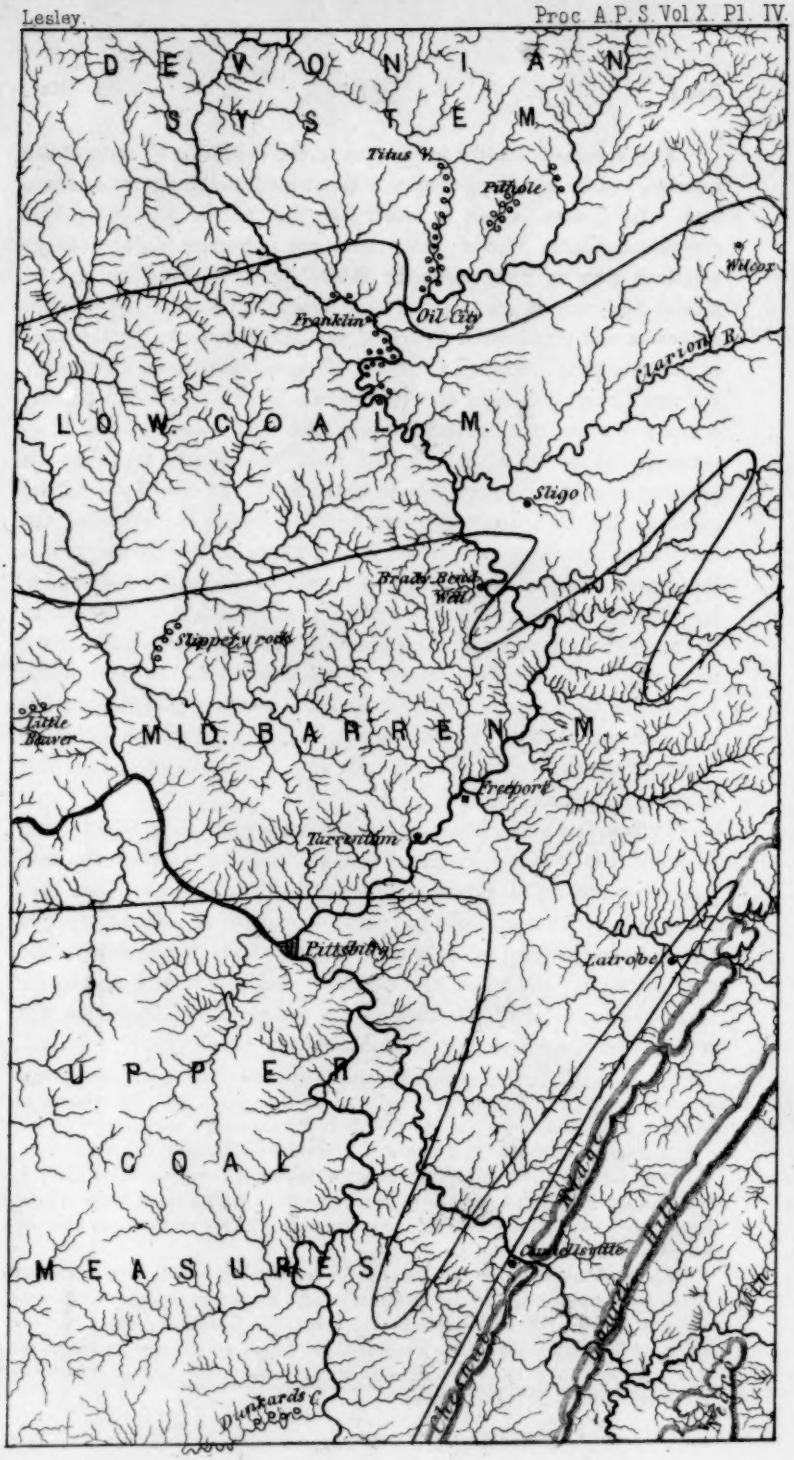
"In form and proportions, this species bears a very close resemblance to one in the Waverly sandstone of Ohio, and also to one in the fine-grained sandstone of Burlington, Iowa; but of neither of these have I the necessary material for satisfactory comparison. It differs from the *S. subcuspidata*‡ of Schnur in the plications of the mesial fold and sinus, and the wider area of the dorsal valve; and also in the same characters it differs from the *S. textus* of the sandstone and argillaceous limestone near New Albany, Indiana."§

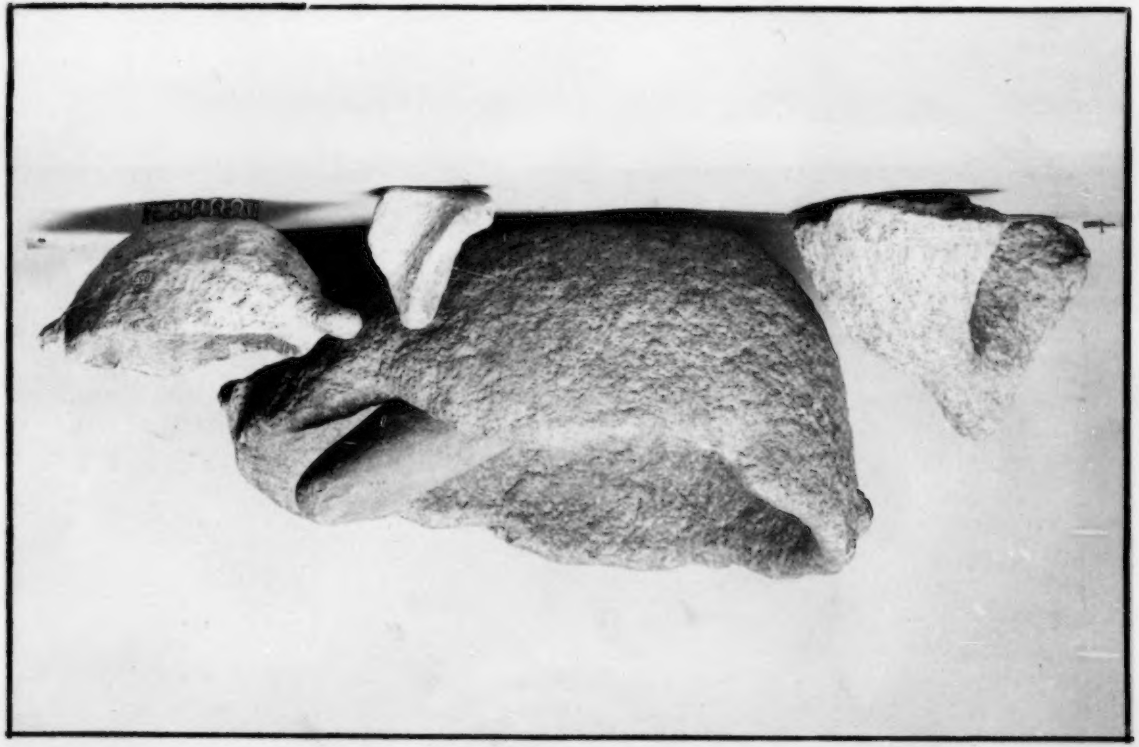
* . . . . .; triangular opening very large, often displaying the internal deep-seated pseudo-deltidium (without perforation, leaving the only opening to the shell at its base); . . . McCoy, British Palæozoic Fossils, p 426.

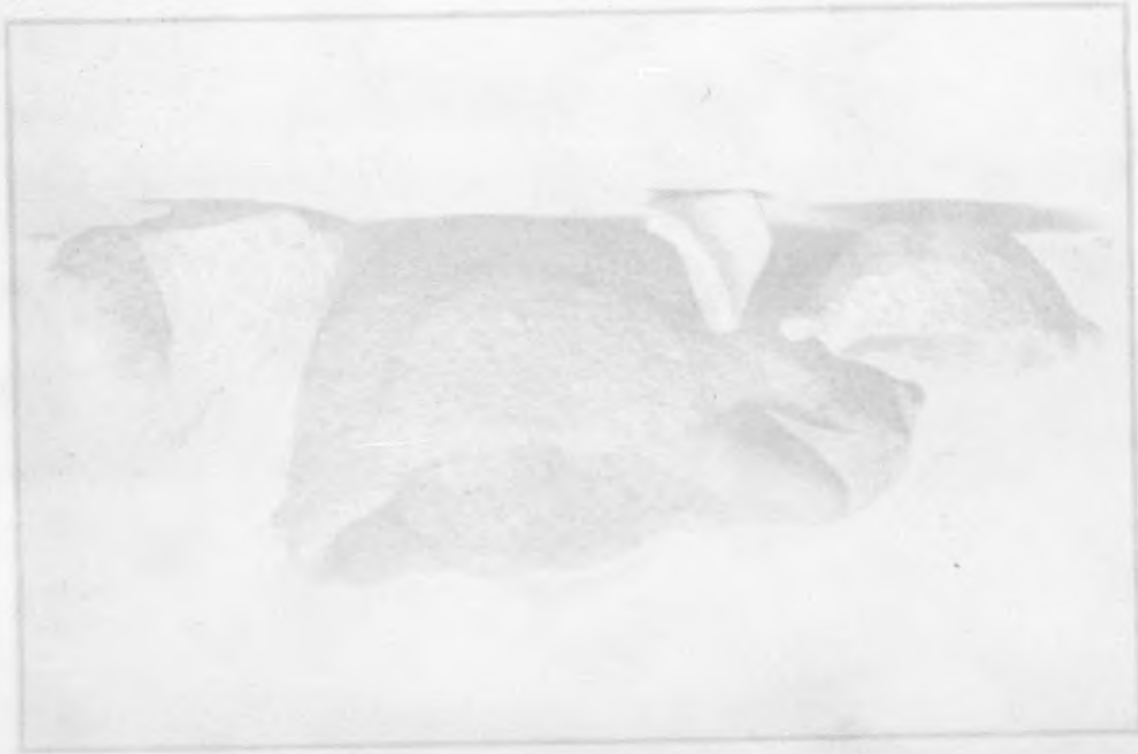
† Monograph of British Carboniferous Brachiopoda, Plate ix, f. 1 & 1 *a*.

‡ *Spirifer subcuspidatus*, Hall, Geological Report of Iowa, p. 646, pl. xx, f. 6, is a distinct species, and apparently identical with *S. textus*, Hall, Tenth Report on the State Cabinet, p. 160: 1857. See Nineteenth Report on the State Cabinet, for remarks on this species.

§ The latter species before alluded to as a punctate shell has the fissure partially closed by a septum, and this is perforated near its apex by a circular foramen, which is continued in a longitudinal tube behind the septum and opens into the cavity of the shell below. The margins of the fissure are grooved for the reception of a pseudo-deltidium as in ordinary spirifers, and this appendage is partially preserved in some of my specimens.


DEVONIAN
SYSTEM.
Titus v.
Pithole
Wilcox
Franklin
Oil City
Clarion R.
LOW. COAL M.
Sligo
Brady Bend
Wall
Slippery rock
Little Beaver
MID. BARREN M.
Freeport
Tarentum
Pittsburg
Latrobe
UPPER
COAL
MEASURES
Connellsville
Youghiogheny R.
Monongahela R.
Dunkards C.





NOTE.

The following photographs of members have been received. Others are earnestly requested to complete the Album. The Society desires, also, to obtain photograph copies of portraits of its deceased members.

Abbot, H. L.
Agassiz, L.
Arfwedson, C. D.
Bache, A. D.
Bache, F.
Baird, S. F.
Bancker, C. N.
Barnes, A.
Bancroft, G.
Bigelow, J.
Binney, H.
Blackwell, T. E.
Boehtlingk, O.
Brayley, E. W.
Bridges, R.
Briggs, R.
Brush, G. J.
Buch, L. von
Candolle, A. de
Carson, J.
Casem Beg. A.
Chase, P. E.
Chauvenet, W.
Clymer, G.
Coates, B. H.
Cohen, J. J.
Coles, E.
Condie, D. F.
Coppée, H.
Crévecœur, J. B. de
Cresson, J. C.
Dana, J. D.
Davis, C. H.
Dawson, J. W.
Delesse, A.
Desor, E.
Dohrn, C. A.
Dorr, B.
Dupont, S. F.
Durand, E.
Elwyn, A. L.
Emerson, G.
Encke, J. F.
Everett, E.
Faraday, M.
Farnum, J. W.
Field, H. W.
Foulke, W. P.
Fox, R. W.
Fraley, F.
Franklin, B.
Genth, F. A.
Gould, A. A.
Graham, J. D.
Gray, A.
Gross, S. D.
Haer, O.
Haidinger, W.
Haldeman, S. S.
Harris, R. P.
Hayden, F. V.
Hays, I.
Henderson, A. A.
Herschel, J. F. W.
Hill, T.
Hitchcock, E.
Hofmann, A. W.
Holland, H.
Horsford, E. N.
Humboldt, A.
Humphreys, A. A.
Hunt, T. S.
Hyrtl, J.
Jackson, J.
Jackson, R. M. S.
Jäger, G.
Kneass, S.
Koninck, L. de
Kupffer, A.
Lea, I.
Lee, T. J.
Le Conte, J. L.
Lepsius, R.
Lesquereux, L.
Lesley, Joseph.
Lesley, Peter.
Logan, W. E.
Lombardini, E.
Long, S. H.
Loomis, E.
Maximilian of Wied.
Miller, E.
Moore, S.
Morgan, J.
Morlot, A.
Morse, S. F. B.
Ord, G.
Peale, F.
Penington, J.
Price, E. K.
Quetelet, A.
Quincy, J.
Rand, B. H.
Roehrig, F. L. O.
Roberts, S. W.
Robinson, M.
Rokitansky, C.
Ruschenberger, W. S. W.
Schinz, C.
Schott, C. A.
Sharswood, G.
Sheafer, P. W.
Silliman, B.
Smith, F. G.
Sparks, J.
Stevens, W. B.
Stromeyer, A.
Swift, J. G.
Totten, J. G.
Troyon, F.
Tunner, P.
Walter, T.
Wayland, F.
West, F.
Wetherell, C. M.
Whitney, J. D.
Whitney, W. D.
Wilcocks, A.
Wilkes, C.
Wister, C. J.